MAIN CURRENTS
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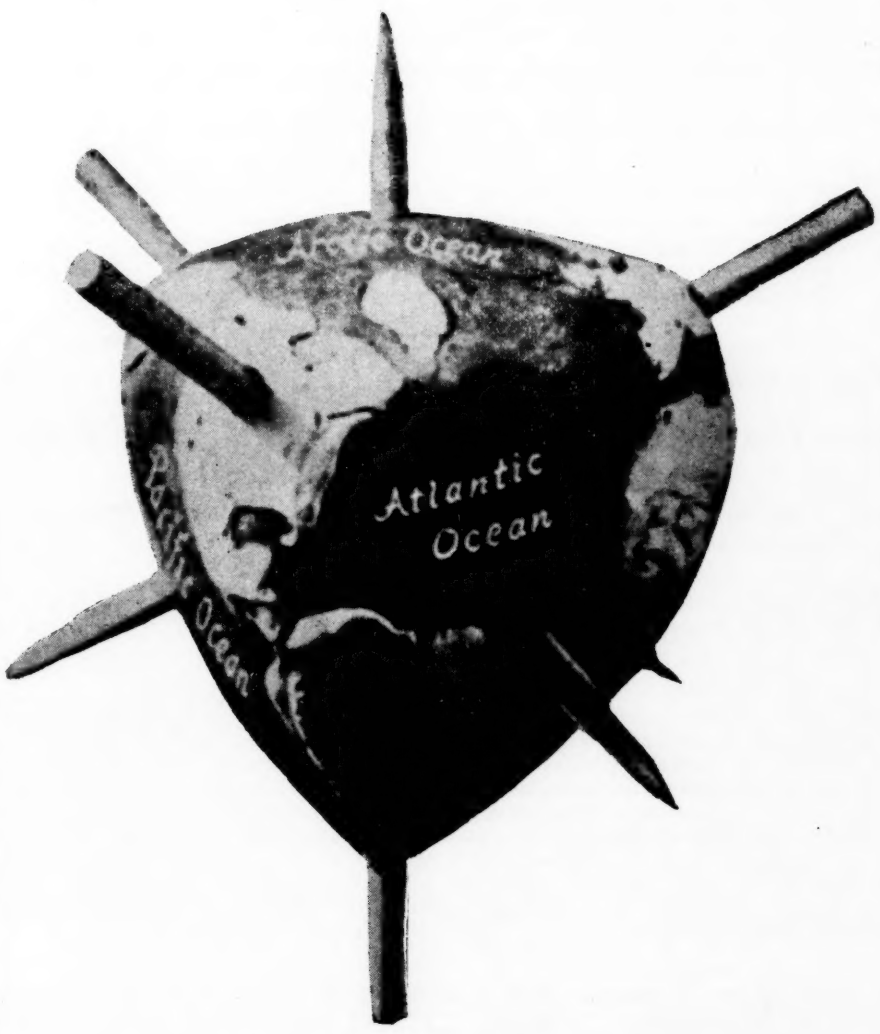

THE WELL-ORDERED WORLD

(SEE ACKNOWLEDGMENT, OVERLEAF)

MAIN CURRENTS IN MODERN THOUGHT

A co-operative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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"Ah, but a man's reach should exceed his grasp, or what's a heaven for?" —BROWNING

ACKNOWLEDGMENTS FOR ILLUSTRATIONS IN THIS ISSUE: (1) The tetrahedral earth-figure on the cover is a photograph of a model taken, by kind permission of the publishers, from an article by Gaylord Johnson in *Popular Science Monthly*, December, 1936, and is based upon the suggestion of W. Lowthian Green. It illustrates the remarks on ortho-geology in the Editorial Summary, page 91, top of column 2, and in *The Living Earth*, in our present issue. A sphere of uniform density approaches a regular convex tetrahedron, as when air is withdrawn from a hollow rubber ball. At the stage shown, four skewers driven through the polyhedron's vertices pass through the area of greatest crustal uplift (Himalayas, Alps, Rockies, Antarctic Mountains) and emerge on the opposite sides out of the greatest ocean deeps. (2) The octahedral figure of the globe on page 96 is based upon a list of the rising mountain areas of the earth, *Scientific American*, April 1928, page 309. These points fall on two great-circle bands at right angles to each other; a third, rectangular to the other two, passes through the poles. (Another useful octahedral globe-projection will be found in *Nature*, December 24, 1932, page 973).

MAIN CURRENTS IN MODERN THOUGHT is published quarterly to call attention to significant contributions to learning currently being made by leading workers in the multiple fields into which knowledge has come to be classified. It relates these advances to each other and to the classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. *Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can be and should be made the central core of curricular study in the educative process at all levels of development.* In condensing text, square brackets [ ] indicate editorial interpolation. Three dots . . . in the text indicates a word, phrase or passage omitted in the interest of brevity or clarity. Other usages are standard. $3.00 a year. Contributors to MAIN CURRENTS enjoy full liberty of opinion and of expression in these pages. **to whom all communications regarding MAIN CURRENTS IN MODERN THOUGHT should be addressed. E. B. Sellon, Associate Editor. Entered as second class matter April 13th, 1946, at the post office at Port Chester, New York, under the Act of March 3rd, 1879.**

ORTHO-GEOLOGY

Editorial Summary

Enough is known about the terrestrial history of energy and life to permit geologists and palaeontologists to look for an over-all order in their departments of knowledge, and state it in exact, even geometric terms, consonant with the studies of order now coming to be so familiar in quantum, resonance, genetic, and other theories. Such a development is required to bring the convincing aspect of science, namely, prediction, into play in geology, and it could lead sociology and political science to something of immediate and practical importance: Through ortho-geology we might come to understand, or at least identify sharply, the inescapably compelling circumstances of our own times.

The reason is evident. The ability of man to alter the conditions of the biosphere, the surface of the lithosphere, the oceans, and the air may be considerable in upsetting, disordering, and impurifying the environment. But there is a limit to this use of our powers. If men render the globe uninhabitable to man himself they shall no longer be here to affect geological conditions even in the present limited range of effects. The alternative to such savagery is to engage in constructive global works, and these necessarily have to be along symbiotic lines.

Put plainly, a global society that is prosperous and cooperative must conform to the basic order, and that is order on a geologic scale. Hence one of the most immediately practical bits of knowledge we need to acquire and disseminate is, oddly enough, not about the gold standard or the available fluid assets of the buying public, but the nature of the present moment and next stage in geology, that most compelling portion of this, our material environment—most compelling, save only solar and stellar radiation. A space-time geology would offer this.

There are those (and we count ourselves among them) who believe this crisis to be spiritual in character. Geologists are naturally conspicuous in this party. When we speak of man, we surely mean man united in soul purpose? And when we speak of Nature, we must mean Nature in vast assemblage, and certainly geology and palaeontology present her to us on that scale? If, therefore, we can find out where is the *totality* of man in the *global* scheme of Nature, we are prospecting as near to spirit as we can get, in an earthy practical sort of way.

Even preliminary examination of the present state of geological knowledge actually discloses some of the required elements of order, in the sense the word is here used. By order, as of today, the widely-read person must mean evidence of properties of space-time displayed through material outworkings, both energetic and living. In geology there is quite a lot of space, and a not inconsiderable largess of time. But among geologists there has been, up to now, very little inquiry into the way in which not space and time separately, but space-time as a matrix, displays itself in sequence and form. Yet they have long known that some sort of geometric energy-disposal is the basic physical fact about our planet. There is a *hemispheric* arrangement; water over one half and land in the other half, of the earth. Then there is the fascinating suggestion made by W. Lowthian Green so long ago, that *tetrahedral* planes and axes exist in the geotectonic realm. *Octahedral* maps of the superficial globe are also significant, and a study of the lines upon which rising mountains are said to exist shows them to be two great circles crossing at right angles, both in turn at right angles to one of the great circles through the poles. Spatially, then, there is reason to believe in a geometric matrix.

But we are proposing now a thought much more precise, and embracing the physical and the biological orders in one scheme. The space-time we conceive is a system having dominion not only over plain and peneplain, but over palm and pine. Why should a geometric be sought only under the material, non-living universe, when it stares at us from every crystal, plant, and animal, and reflects itself to us out of our boudoir mirrors? No one, surely, is going to suggest separate metrics, innumerable matrices, which never come together in one grand orchestration of ordered resource? Nature's own economy, and ours of thought, forbid such rank waste. Behind geology and palaeontology must lurk one and the same grand potential, a union doubtless of both Euclidean and non-Euclidean geometries, conics (so to speak) at infinity. The properties of this matrix are apparent to us only as cold mathematical abstractions at present. But already the resonance theory of the chemical bond begins to bring the aesthetic continuum into play. We may suspect that the matrix is indeed a fullness. The implication of the scientific knowledge of our times, therefore, is not that gross physical changes of cooling, shrinking, climatic variation and the like caused the biological progression, but that some system common to both has ways of expressing itself indifferently through energetic and through biological aspects of Nature.

Plato and the ancients and the orientals in general saw this system as geometric, as we do, although among them the explicit union of space with time had not come about. As a substitute they employed the notion of Elements (here capitalized) which were equated variously to the regular convex polyhedra. After the time of Kepler this concept of Earth, Water, Air, Fire and Aether fell into disrepute, but it is easy to see that, by whatever means of inquiry he employed, the classical thinker was close to the truth in his own way. Today the word "elements" means the chemical simples, but when we examine these we find that they display a geometrical feature of great importance, valence, which rests upon a deeper harmonic order of the moving electrical constituents. So our modern findings, narrowly channelled and eminently practical, confirm in a general way the notions of the older philosophy, which latter affords us in place of close exactness a more comprehensive view, taking in as it does living orders and human society.

It is easy for us, with the vanity displayed by every age, to dismiss these early ideas as undisciplined speculation. But we ingrates live on the arts and the political outworkings of the thinking of antiquity while we despise its science. The attitude involved in thinking about the Elements could be recovered by a proper rereading of the ancients, provided efforts were made to free our modern mind from its special commitments, and to enter into the spirit of the classical ages. That is difficult to achieve without extremes of obscurantism or of condescension. There is another way to proceed. Lodged safely on fact, we may more securely reorganize contemporary knowledge in the older terms. This could usefully, and should properly, be done by high authorities in the geological sciences. Anticipating this, we here recklessly embark upon a sketch of that grand, yet detailed, cyclorama of space-time, using the following assumptions:

1. It is assumed that the space-time lattices (as they really are, and not in the partial forms so far detected by mankind) display grouped properties, both in the energetic mode, and also in the morphology of biological species. We shall call such a group an Element. 2. In the point of view here assumed—a positive monism from which energy, life and human self-conscious spirit arise—each geological era is treated as a Couple, which consists of *a preparatory era* in which the emphasis is on elemental energetic conditions, and *an era of realization* in living orders of the very same geometric necessity, now biologically displayed. 3. Crystallography is to be taken as a part of the science of living order, and the metamorphosis of the igneous rocks in particular is a kind of evolution, seen more wondrously in the true biological metamorphic sequence. 4. The crystals, the cube-octahedral group, stand at the origin of the bifurcation of life and energy. 5. The extent to which higher species can display the geometric resources of the space-time lattices is naturally *limited* by the three-dimensional space parameters, and *increased by* lapse of time (evolution). This fits the facts. Crystalloid radiate and centrosymmetries come earliest. Although linear and quasi-bilateral symmetries, and even full bilateral symmetry (trilobites, for example) are displayed from almost the earliest geologic times, the full amplitude and variety of the linear and planar symmetries is accomplished only when colonial and organic living becomes possible through the evolution of appropriate kinetic (time) media, especially streaming protoplasms, which embody in their perpetual motion the hidden resources of a four-dimensional source. The waters of the earth required by plants are more kinetic than the crystallizable magma. The gases needed for air-breathing animals are still more fluid, and fire even more relevant to change; and they appear on the planet (in the sense we shall use them) in that order.

The first Couple of eras consisted of the Archaeozoic preparation for the Proterozoic outworkings. The globe was more homogeneous, more single-elemented, than it has since been. It was preparing to acquire the thin skin of relative stability it has since displayed, but at that Archaeozoic time the magma was not yet confined under a lithosphere, and the temperatures and pressures were such and so disposed that the earth can scarcely be said to have been solid, liquid, and gas. It is to this state of affairs we shall apply the old term Earth, capitalized, to distinguish it from other uses of the word. There was then a thrusting and rethrusting of crystallization, an elemental struggle toward primeval stability, in which the whole globe was engaged, possibly because there was not then the sharp distinction we now make between core and crust. If there was life in any proper sense of the word, it was working through centrosymmetrical crystal forces, not the colonial adaptation we see in biological forms. Centrosymmetries and radiates were the rule. Evolution was proceeding (or more truly was being prepared for), primal evolution in the sense of rock metamorphosis. In the Archaean we find the bulk of the subsequently metamorphosed rocks, as if that Earthiness were in itself a species of life, life almost at its Elemental root.

Then comes the Great Unconformity, the first of those little-understood global transitions which go under that name (or Revolution) in geology. The planet reclined in some sort of monstrous labor, an agony of upheavals, continental or mountain building and no less mighty wearings-away, in preparation for the next ordered stage. It is not impossible that we shall presently find that these transformations are different when they are between two elements of one Couple and when they are between two Couples.

After the first great unconformity, the Proterozoic came in, to work out the events prepared for in the Archaeozoic. This is the second half of the Earth-Element Couple, and in this era we see indeed vast discharges of metallic minerals, upon a scale never since approached. There are also great sedimentations, different from the later water-borne kinds. Evidence of biological life has possibly been detected in strata laid down toward the very end of this out-working Palaeozoic; but if it be confirmed that these fossil traces are in truth algae, then we must expect them to be (if they are truly living species) evidence of the coming separation of the juvenile waters from the magma. For life and water are close-tied phenomena. But true biological life was still on the threshold, and the calcareous algae, if such there were, were creatures which resembled rime and hoar frost, built up on principles of cleavage and glide planes.

This first Couple, expressing the lusty Earth Element, ends with further diastrophism. At these remote times we are unable to say whether it was continental elevations (epeirogeny) or mountain-lifting (orogeny) and down-wearings, which preceded the parting of the waters from the earth; but the second Couple, which occupies the Palaeozoic as a whole, displays that two-Element state of Earth and Water. It is held by some that those same juvenile waters occur today as part of the constituents of geysers. However that may be, the parturition of the Earth to give birth to the Water Element was a necessary prelude to the coming of true biological life.

In the earlier half of the Palaeozoic Couple we see preparation in this separation. And in this preparatory stage the more fundamental kinds of geometries of the

Couples & Periods	Minerals & Materials	Plants	Animals	Elements & Kingdoms
CENOZOIC II	COMING AGE IN WHICH MAN WILL REALIZE THE RELATION BETWEEN GRAVITY AND ELECTROMAGNETISM AND TAKE HIMSELF IN HAND BY MEANS OF SELF-CONSCIOUS, EDUCATIVE PROCESSES.			AETHER ELEMENT
	Psychocene			MAN
	CASCADIAN (CONTEMPORARY) DISTURBANCES		WARM BLOODED MAMMALS triumph. Carnivores replace Creodonts. Archaic mammals vanish. Many modern reptiles & birds. Lemurs & other modern mammals. Archaic mammals rise.	
CENOZOIC I	Pleistocene Pliocene Miocene Oligocene	Four glaciations & three interperiods in northern lands. FIRE important to MAN, who occurs here. Warm climate world-wide.	Southern types replace n'thn. Grasses, pines, oaks, sumachs.	THERMO-DYNAMIC OR FIRE ELEMENT
	Eocene			
	Palaeocene	LARAMIDE REVOLUTION		
MESOZOIC II	Cretaceous	Climatic zones appear. AIR achieves something like its	Ferns, cycads, ginkgo, conifers still predominant.	GREAT Great SAURIANS flourish and decline, on Land, in Air & Sea.
MESOZOIC I	Jurassic	NEVADIAN DISTURBANCE		AIR ELEMENT Triumph of Bilateral Symmetrics
	Triassic	present characteristics.	Land (air) plants specialize.	
	Permian	APPALACHIAN REVOLUTION		
PALAEOZOIC II	Pennsylvanian Mississippian Devonian	Air less watery. Fresh from salt The WATERS separate	GREAT PLANT TIMES Land flora begin	INSECTS, pore-breathers, mostly damp-livers. AMPHIBIA, tied to water for reproduction. Possible terrestrial vertebrates. Lung-fishes, scorpions (air-breathers) begin.
PALAEOZOIC I	Silurian Ordovician Cambrian	CALEDONIAN DISTURBANCE Seas from land	Sea-water plants	FISHES, water animals par excellence Higher early marine invertebrates Sea-crawling trilobites (perish in Permian). Sea-water plantlike animals.
	Killarnean	GRAND CANYON REVOLUTION		WATER ELEMENT Plant-Invertebrate Symmetries in Water & on Land
ARCHAEOZOIC II	PRE-CAMBRIAN	Great Era of METALLIZATION The sediments differ from later water-borne sediments.	Possibly some calcareous algae; clumped, globular fossil remains. LIFE, in a colonial and organic sense, does not occur.	
		GREATEST UNCONFORMITY (Laurentian)		EARTH ELEMENT Crystal & Centrosymmetries
ARCHAEOZOIC I		The bulk of the metamorphosed rocks here.	LIFE, if such there was, was centro-symmetrical, radiate, crystalline, and like in form.	

kingdom of the plants receive natural emphasis: Plants manage their nourishment now, when on land, in the main as they did then in the seas, as water-diluted drinks and breathings. Colonial living around stems, with anchored bases or real roots, was the great order of the day, even among creatures we consider animals, and even with those which were not linear in their symmetries. The emphasis is on plant forms, even among animals, for ages. The primitive dendroid graptolites, both anchored and floating types, occur in numbers. The cell-tissues are still geometrically angular (theca) built out like rime into enfrosted branches (stypes). The float capsules of those free of the sessile habit are radially surrounded by the brooding organs (conangia). The brachiopods are chitinous and equipped with a foot (pedicule) for anchorage. The relatively few varieties of true bilateral symmetries are revealing in their history. Trilobites, sea crawlers, forecast the arachnids and insects, and sauria and mammals in this particular. And we note that they, appearing at times so elemental, and managing to live throughout the Palaeozoic, suddenly vanish in the Permian, when the mammals, the preeminent expositors of bilateral symmetry, took secure place in conditions now suitable to highest usefulness in bilateral forms. We are not suggesting a physical ancestry, but its very opposite. A union of Darwinian and Lamarckian thinking is required. The bilateral Idea is there in the space-time lattice, and as soon as conditions allow, it must perforce present itself in form. But it is in truth suited to an age which the geological series does not yet provide on the planet. Hence, with the coming of the conditions best suited, these primitive bilaterals have no further point. It is as if the inward latent geometry is impatient of these dead-end forms, now that its full opulence can be expressed.

We may regard the preparatory half of this Earth-Water, or two-Element time, as extending from the Cambrian, through the Ordovician and Silurian. The planet was experiencing fission as a whole, so to speak, old Earth dividing into new Earth (magma modified) and juvenile Water, the latter later to redivide as salt and fresh. The style of forms was also in two kinds: 1. There were the stemmed and colonial, largely sessile, creatures, plants or plantlike in appearance, even if animal; graptolites, corals, echinoderms (cystoids, blastoids, crinoids), molluscoids, sessile, save in very young stages. 2. There were variations of the bilateral theme, instead of basic linear symmetries, in pelecypods, nautiloids, and ostracods.

The second half of the Water-Earth Couple, Devonian, Mississippian, and Pennsylvanian, is the full realization of the foregoing system. Now terrestrial sediments are significant for the first time since the Proterozoic, and the first undoubted evidence of fresh water deposits appear. The planet enjoys a second birth of fresh water from salt water, and a third is foreshadowed in extremely moist atmosphere differentiated a little from the rest. Inasmuch as the later Palaeozoic is preparatory for the next geological Couple, we may read into the appearance of the fishes, especially the fresh-water fishes, which were ancestral to the amphibia, the concept which we are exploring. Fishes are abundant in the middle Palaeozoic. In the watery element experimentation and perfection of the true bony bilateral form is carried through, later to be adapted to its highest use, locomotion in a straight line on land. The procedure of nature thus makes an intelligible whole, as if a potential is expressing itself in systematic order. Yet the emphasis is on Plant—marine, fresh-water, land; and upon the elementary correlate to Plant, which is Water. The animals of those times are tied to this element by their reproductive habit even when they crawl ashore as transient and not finally very significant amphibia. It is not too far from fact to suggest that we have here a two-element biological system: (1) The plants, the plantlike simpler animals, the insects—plants on wings, segmented, pore-breathing, leaflike as to wings—and (2) the bony animals, still bound to the two-Element circumstances of the times.

That second Couple ends with the Appalachian Revolution, the planet laboring for another birth. Before that giant event comes about, the Permian reviews the past and the future. The trilobites vanish; the cystoids and blastoids likewise perish. The quaint amphibian experiments of the two-Element times (stegocephalians) approach their doom. Reptiles are forecast in the form of Naosaurus, Dimetrodon, Colytosaurus, capable of embryological fulfilment on dry land. The period is truly transitional for both plants and animals; and doubtless we would see it so for minerals as well, if we but knew more of the rules of metamorphosis. At any rate the Plant Kingdom has had its day, as the Crystals in the first Couple had had their own. After Appalachia these were to be subordinate to Animal, and for the use of animals Air was to be added to the elemental resources of the planet. The atmosphere of the coal-measure days, so wet that an observer would have been hard put to declare where lakes ended and air began, is now to precipitate some portions of its water, and a stage to be organized for life afresh, the scene now a new Earth (how modified, geologists must tell us), a new Water (vadose and superficial streams increasing), and an Air resembling the mixture of oxygen, nitrogen and the noble gases of our times.

Bilateral symmetries triumphed. These are the highest possible in three-dimensional frames. The revealing activities of life are to be seen in the vast saurians, perhaps even more remarkably in the reptilian-like egg-laying mammals, animals all. The saurians, with their three-plexus control in the nervous system, conquered the land, took to the air, and even returned to the water. The mammals were even more successful in all media; the sea cows partially, the whales fully marine; the birds well-adapted. These are not the half-committed two-Element amphibia of Water-Earth, but the true animals of a given element, for the whale is an air-breathing animal swimming in the seas. Through the Triassic the preparations for the full three-Element stage goes on; in the Jurassic and Cretaceous triune life triumphs and the dinosaurs are extinguished in late Cretaceous times. An animal of the internal combustion, warm-blooded type, has been devised for the Fire Age which is to follow after Earth-Water-Air.

The Laramide Revolution turns the world in prepa-

ration for that four-Element situation, and for Man, the fire-using creature, appearing in the first half of the present Couple. The concept is inevitable that *the Cenozoic is the first half of a new Couple,* and that fire-using man has run his course, his preparatory course, which ended effectively on August 5, 1945, when the human world realized it had come with a shock to the end of an age. Fire is but the face of a more truly Elemental entity, as the photosphere of the sun is but the superficial aspect of a deeper trading of the sun's mass with the space-time resources of the universe. We must look upon all that has happened from the Laramide Revolution up to now as merely preparatory, and we may declare precisely for what it inevitably makes the globe ready.

In the Cenozoic, archaic mammals rise out of the Laramide Revolution, and are to flourish in the Palaeocene and to vanish before the Eocene has run its course. There, in their midst, come the Lemurs and some other progenitors of modern mammals, to triumph in the Miocene. The trees go modern, and world-wide warm climates (Eocene) accompany the coming of these Fire-age creatures. Something deep is at work: The warm-blooded mammals triumph in a *warm* climate. The Alps, the Apennines, and even the mighty Himalayas are renovated with new spires pointed to the sun above their high snows. Four glacial epochs come, with interglacial eras thrust between them. These seem to review the diastrophisms of the great earlier geological eras. In the struggle with the colds descending from the northern regions, man, the fire-user, emerges.

At last he is as we have seen him: builder of homes around hearths, of cities around dumps of fuels, user of waters lifted to mountains by the sun's fire-power and descending as waterfalls. We see him burn wood, peat, coal, oil, all made by the sun's fire, and we see him using the fire-power in his barbarous wars; finally the elemental fire of break-down chemistry, near to the heart of the ordered aetheric harmonics at the core of the atom: Man, local, tribal, national, competitive, living around his camp, hearth and temple fires, his forges and his Bessemer plants: Man, unselfknowing, obedient to his animal nature, playing with flames: Man, the *unsymmetrical,* bilateral creature, beyond symmetrical innocent animality, in his very structure displaying soul against Freudian psyche, left against right, virtue against passion, budding creative spirituality against subsiding Mesozoic animality. Such is the Man of the Flames, flames passionate and animal, a mere preparation for the Man of his true Element, the Aether, that is to be employed in the coming second half of the present Four-Element Couple.

The question may be raised: Is the planet really so ordered and prepared, or has man not merely exploited it? Let us examine this Element, Fire, in simple terms of fuel.

Solid hydrocarbon fuels are found, starting with wood, stretching downward from the surface of the earth, and consist of a series which begins with peat (partially carbonized vegetable matter) in surface bogs; lignite, in which peat, altered by pressure and bacterial action, transforms through a brown jellylike substance to the compacted lignite, at deeper levels; soft or bituminous coals; hard or anthracite coals, "metamorphosed" from the preceding; and finally graphite, metamorphosed to nearly pure carbon, the same atomic stuff as is the diamond, but very differently arranged within. Since these materials are mainly of vegetable origin, they can originate only at plant horizons in the geological series. Furthermore, lignite, coal and graphite must occur at those depths wherein temperatures and pressures and time-lapse provide the metamorphic forces required. Hence graphite is found just short of the zone of igneous rocks and extends upward through the whole of the metamorphic zone into the lower levels of cementation. The coals occur in the strata which compose the middle and late Palaeozoic, and lignite is found in later, and peat in relatively recent formations.

The origin of oil, the fluid companion of earthy coal, remains unexplained, although its composition is believed to be derived certainly from plant and animal materials. Whatever the original source, it is not believed to have originated in the sedimentary formations in which it is now found. As a liquid, unlike coal, it can migrate. It occurs down to levels of the Ordovician, and all the way up to the earth's present surface, except the Triassic, according to present knowledge. A significant and important kind of pool is that found along the flanks of salt domes, places where the conversion of salt water to fresh water went on on a vast scale, as it did from the earlier to the later Palaeozoic. We have, then, great accumulations of animal and plant bodies of marine (earlier and later Paleozoic) origin, and great accumulations of fresh water creatures (later Palaeozoic), converted under the same general conditions which gave us coal, but now into liquids, not solids.

Thus we see Nature providing two states of fuels in those horizons where the two-element stage of the planet was in force. Their constitution is not determined entirely by pressures, for good bituminous coal is not merely lignite metamorphosed, but contains spore cases and carbonized wood in sufficiently great quantities to give us a true coal. In the case of the coal the gaseous element is compacted chemically into the solid mass, but in the case of oil the gases may occur separately, and the fuel oils occur not only in the two-element levels, but throughout the three-element levels of the Mesozoic.

We are suggesting that it would be of interest to examine the whole as yet unresolved question of the origin of all the fuels in terms which assumes *a general order of events,* however obscured by great numbers of local variations which we now speak of as anticlines, synclines, faults, unconformities, lenses, salt domes, and the like. We should bear in mind that the coal, oil, and gaseous hydrocarbon fuels have been of immense importance in the terrestrial birthing of man, whereas they are but the mortuaries of creatures. From Nature's death was born fuel-using social man.

This fuel comes to the fire-using human in all the three elemental forms of solid, liquid, and gas, which characterize the three earlier eras which preceded his appearance. If we pre-judge the history of the planet out of a philosophy of simple materialism, such rounded-out gifts of Nature have no meaning. But if we are to

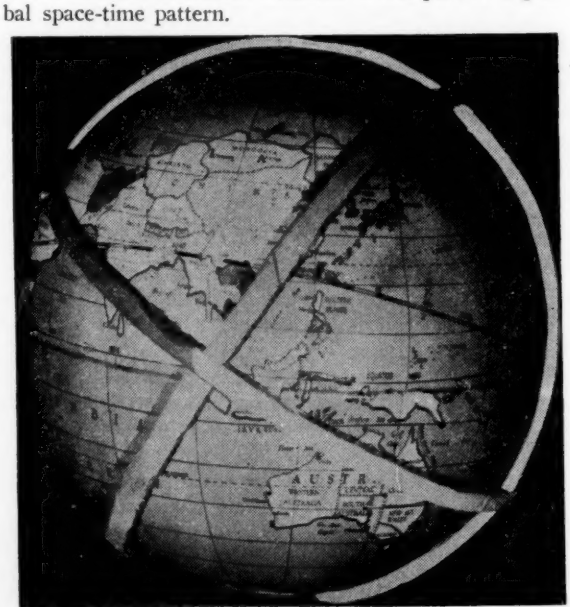
have a science which is large enough to embrace life and man, to lend itself to meanings, while not being itself corrupted by obscurantist intrusions, we are permitted to see in the origin, classification, and use of the fuels a scheme of things and not a meaningless nightmare of chances. In the fuels Thermodynamic man has found representatives of Earth, Water and Air in orderly appearance: We may suppose that the anthracites and the oils derive from early times when solids were parted from liquids by some general rule encompassing also the appearance of solid continents from the fluid seas. We may inquire into the appearance of soft coals in terms of fresh waters and the coming of a genuine atmosphere. We may ask whether coal is mainly plant, and oil chiefly animal, in origin. In short, without a defeatist teleology, we may ask whether there were not grand transformations impressed upon matter and life alike, as part of a sublime order hidden within the material transformation, but available to the eye of the mind.

The outcome of geologic studies in these terms would force, as no popular beliefs could, constructive action. The atom bomb has frightened us. We now need to know what we have to do, not merely what not to do. What, then, have we to do? We have to pass from thermo-dynamics to Aether.

The rumor that Einstein has abolished the ether is false. The modern physicist has only abandoned the idea of a semi-material, local, and quaint ether of the last century's materialism. In its place he shows the true Aether, a cosmic and hence a global Element, not the dump-element of fuel-fire which bound man to place, while he developed. The physicist has given us light as our constant, the electromagnetic pulsing of the plenum. To use this, man must rise to his terrestrial unity as a species, using the etheric power to unite the globe externally, as geologic process has displayed an ordered unity at all times within. He cannot escape his geologic destiny.

As we have known him, passionate man must perish. Those nations, round their little dumps of gold and coal—they who mean blindly or willfully to use the violent fringe of the ether's power to destroy other men—will themselves perish, and the global Aetherman will arise from those willing to give man his economic as well as his political freedom and security. Geologic nature can start over, if need be. She has her sub-species of man to work with to perfect the species. We Americans, we British, we Russians—we are but nothing. We Men, we are all. The massive march of the globe's titanic forces moves on. Earth, Earth-Water, Earth-Water-Air, and now Earth-Water-Air-Fire, have had their times and their creatures in three and a half Elemental rounds. They have expressed the latent beauty, sentience, and purpose of the space-time matrix: Centro-symmetries, point-local crystals; linear symmetries, plant-reachings; quasi- and true bilateral symmetries of animals searching; and the bilaterally unsymmetrical man, the soul, victimized so far by psyche—all these have run their course. The hour strikes for the emergence of self-conscious man, the knower and the potential master of the lower self, the animal self, that he may assert from the aetherial height of spirit his will to be free and united.

Each geologic Couple is ushered in by a Revolution, and each transition from preparation to realization of an Element is signalized by an Unconformity or Disturbance. How these differ is not quite clear, but if we are now at the end of the limitation of thermo-dynamics and in preparation for social use of electromagnetics, then an Unconformity is going on. But it incorporates some Revolutionary features. As the uniqueness of man lies in his psycho-spiritual apparatus, in contrast with animal mesozoic bio-psychology, the Revolution is chiefly spiritual and psychological, and takes the form of aggressive Europe's adjustment to the required peaceful world-context. We may speak of a psychozoic Revolution and a European Unconformity in preparation for a new human situation. As in geology, it is rigid and conservative forces which make social changes violent. The rear-guard action of imperialism (political and financial), trying to use atom-power for power-politics, leads to a violence which is falsely attributed solely to Russia. Ortho-geology shows us that progress is inevitable and patterned. We conclude, therefore, that if ignorant, evil, and selfish men succeed in crystallizing the old around the new, then deeper natural forces may come into play, and we may witness physiographic upheavals which will shock mankind even more than the threat of atom bombs in global war. It is the essence of ignorance to say that England will always rule the waves, when it may sink beneath them. It is blatant patriotism to suppose Russia has an eternal right in mid-Europe, when mid-Europe may some day be under the sea. The North American mid-west may feel smugly secure, but its lacustrine and marine fossils are as much premonitions as they are records. We do not know just when and where the energetic-biologic forces of the globe will operate to new ends. But ortho-geology convinces us that the human situation is still part of a global space-time pattern.



For description see Acknowledgment, p. 90.

THE LIVING EARTH

R. P. Whorf

The Platonic idea suggests that the visible world is a living creature with soul and body created by God. The findings of modern physical science have broadened our views of life, in terms of order, evolution and purpose. How do these two sources of philosophy consort with one another?

Plato gives us the clearest expression of his ideas on nature and creation in the *Timaeus*.

> ". . . was the world, I say, always in existence and without beginning? Or created, and had it a beginning? Created, I reply, being visible and tangible and having a body, and therefore sensible; and all sensible things are apprehended by opinion and sense and are in a process of creation and created . . .
>
> "Now the deeds of the best could never be or have been other than the fairest; and the creator, reflecting on the things which are by nature visible, found that no unintelligent creature taken as a whole was fairer than the intelligent taken as a whole; and the intelligence could not be present in anything which was devoid of soul. For which reason, when he was framing the universe, he put intelligence in soul, and soul in body, that he might be creator of a work which was by nature fairest and best. Wherefore, using the language of probability, we may say that the world became a living creature truly endowed with soul and intelligence by the providence of God."

Plato's cosmology thus departs from the old Ionian conceptions in that the emphasis has shifted from the idea of matter to the idea of form. *Timaeus* never explicitly says that God made the world out of, or in, any pre-existing matter. The matter of the *Timaeus* is that which is inherently capable of assuming geometrical form. This form constitutes in itself an intelligible world which is a presupposition of God's creative act. It is the eternal and changeless model on which was made the temporal world of nature.

The world of nature is a material organism alive everywhere with spontaneous movement. The world of forms is alive because the forms are dynamically related to each other, but not alive with movement. Movement implies space and time, and the world of forms has in it no space and time. Space corresponds to no feature of the intelligible world. Space is simply that out of which the copy is made. It is presupposed and no attempt is made in the *Timaeus* to show that God made space.

Time, however, according to the dialogue, is not a presupposition but one of the things God created. Yet it must correspond to something in the intelligible world, as it must be created on some model. According to the well-known phrase, God made time a moving image of eternity, which is immovable. Eternity is the positive something which involves no change or lapse as it contains everything necessary to its existence, i.e. everything realizes its entire nature simultaneously. Time came into existence simultaneously with the world of nature. Thus creation was not an event in time, but an eternal act.

Timaeus next considers the creation of the world's soul, which transfuses the whole body and envelopes it. Thus, according to Plato, the whole world is conceived as apprehending by its thought the eternal forms upon which its movements are modelled.

With this very brief account we leave Plato, but it is well to remark that this Platonic cosmology is held in high regard by A. N. Whitehead, whose judgment deserves the deepest respect as one of the greatest living philosophers and living writers on cosmology. In Whitehead's opinion, the *Timaeus* comes closer than any other book to providing the proper philosophical background required by modern physical science. There are departures in the conceptions of the two philosophers, but for both the world of nature is a complex of processes taking place in space-time and presupposing another complex of forms, which Whitehead calls "eternal entities," not in space or time. Whitehead constantly asserts that reality is an organism; that every existing thing resembles a living organism in the fact that its existence depends not on its components only, but on the pattern or structure in which they are composed.

To decide whether or not we regard the earth as a living being, we must consider what we hold as our idea of life. There have been innumerable conceptions and doctrines as to the nature of life. The Greeks held that which is extended to be material; that which is moving, as alive; and that which is orderly, as intelligent. The modern biologist assumes life to be explicable in terms of physico-chemical structure. This is merely a belief, and cannot be accepted until living matter has been experimentally produced from non-living matter. All the attempts of the Darwinian evolutionists to get at the origins of life have equally failed. All they can say is that life is begotten from other life, and that all speculation about the first germ of life is hopeless. Life remains as fundamental and as irreducible as energy or intelligible process.

If we agree that life is phenomenally distinct from matter and energy, then we must look for the effects of that life as exhibited through matter and energy. The physical sciences can help us from their exhaustive studies of matter and energy, now that it has been shown by Einstein that matter and energy are fundamentally one and the same thing, and that the relation between them is given by a simple mathematical formula involving the constant velocity of light. The role of light in the life process is fundamental. All these gains encourage us to reexamine Plato's ideas in fresh terms.

Growth is a particular attribute of life. In growing, an organism develops from the simple to the more complex. The growth of our planet is a story of a probable fiery birth, the development of a molten globe into a complex dynamical entity, passing through great geological cataclysms. It is the story of an emergent evolution. But more significant than growth is the existence

of order, evidences of Divine order, appearing in symmetry, pattern, beauty, and a dynamic relation between forms. We find the documentation of this order in the physical sciences, testimony of an intelligible world of which the world is a result.

Investigations into the shape of the earth, and the theory of its development give us instances. In the words of F. W. Westaway: "Careful examination of the distribution of land and water over the surface of the globe suggests some kind of ancient basal planning. We notice, for instance, a predominance of land in the northern, and of water in the southern, hemisphere; that many of the geographical units are of triangular shape; that the great continents form a nearly complete ring around the northern hemisphere; that only about 1/27 of the land has land antipodal to it, and other 26/27 being antipodal to water; and that in the northern land hemisphere there is a polar ocean and in the southern water hemisphere a polar continent."* And again, "Apparently, then, the general form of the earth and the irregularities of its surface may be regarded as the effects of . . . causes of a dynamical character: gravitation, rotation; a tendency to an ellipsoidal figure, associated with the attraction of the moon in a bygone age; shrinkage due to cooling; the eccentric position of the center of gravity arising from a past state of inadequate resistance to compression; and variations of and interactions between these various causes."*

The researches of W. Lowthian Green provide us with a picture of the earth as a convex tetrahedron. The figure is that of a hexakistetrahedron as it approaches the sphere. If, by gravitation, 5/7 of the surface of a tetrahedron were covered by water, we would have a rough approximation of the land and water distributions on the earth.

In the system of the planets we observe a discoid inclined at a slight angle to the axis of rotation of the sun, which points to some powerful genetic agency competent to enforce on the system the geometrical form it now bears.

The magnetic and electro-magnetic sheath in which the earth is engulfed presents many mysteries and splendors. Among these are the great polar ionic precipitations called the auroras, which are in some way connected with solar emissions and terrestrial electromagnetism. The earth's magnetic field which, to a first rough approximation, may be represented by a centrally located dipole, is actually best represented by a complicated harmonic function. The earth's large negative charge, which has long been one of the big mysteries of terrestrial magnetism, is partially accounted for by 1800 thunderstorms known to be continually in existence. We can picture the globe from center to uttermost ionosphere, and beyond into undetected fields, as a kind of etherial, streaming, cored organism, not unlike a streaming protoplasmic cell, having as its nucleus the familiar crust and mysterious core.

Slowly we are achieving an accumulation of data about the globe not readily explicable upon physical science terms alone, yet from physical science sources. As this mass of information is assembled, the insight of Plato is more and more justified. For the modern inquirer this is highly significant. For the problem of enfolding all forms of knowledge into one relevant system would be hopeless of solution in any measurable time could we not be convinced that man has in him an intelligible principle which operates ahead of strictly logical and pedestrian procedures — an intelligible principle which permits us to detect the operations of life with matter as certainly, though not as exactly, as logical process can itself cope with matter and energy. Plato's insight was achieved and recorded in the *Timaeus* long before contemporary data came to its support. Why should we not hope, aided by recent gains in knowledge, to understand the world even more fully? It is true that a new responsibility rests upon us, to be true to objective science at all stages of actual study. And this responsibility has thousands of rootlets into a vast soil of complex data, living and non-living. But the very richness of the soil is in itself at the same time an advantage peculiar to our times. We have only to re-discover and employ the techniques of insight, the workings of intuition, to bring order out of the as yet too chaotic masses of information. Plato's example encourages us to take up this task upon the very same principle that he employed, geometry, now enlarged into manifold forms which have come into use during the generations intervening between the times of Pythagoras and Plato and the time of Minkowski, Einstein and Whitehead.

* Westaway, F. W., *Science and Theology*, Blackie & Son, London, 1932. Ibid, p. 140. p. 139.

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The Editor Regrets

The present issue of Main Currents is about three weeks late, which we regret. The Editor has just completed a coast-to-coast tour in the interests of the integrative policy of the journal, and this labor, which occupied nearly four months, has cut deeply into available time. It has, however, enriched the connections of the journal with the world of higher learning, especially through individuals actively conscious of the immediate need for curricular centralizations based on adequate conceptual gains.

A very considerable variety of efforts are being made on many campuses. A Basic College at Michigan State, core courses and preceptors at Colgate, re-evaluation at Union College, the commitment of Knox College to a system of tutors and integrative advances, special committees in some university faculties (Montana State, for example), nation-wide studies such as that of Dr. Weg-

ener which we report in this issue, specific demands by superintendents of schools for meaningful integrations at secondary school levels such as may restore an eagerness for study and philosophical reaching among adolescents now so crassly exploited in their emotions—these are a few instances of the most important tendency of our times upon which report may be made in due course.

With this issue MAIN CURRENTS concludes its fourth volume. It has upon its list of recipients many institutions and individuals concerned with the state of the higher learning and the conceptual breakdown. We are at a stage in our development when we can serve these colleagues, and many yet to be found, in a concrete manner which should be clear in our next volume. But to do this we require help, a wider circle of subscribers, and active concern about the movement the magazine represents. These forms of assistance must come to us from our present list. *It will help if you will please personally consider what you can do to bring to us, as subscribers, your institutional library, your academic department library, other distinguished educators in teaching and in administrative posts on campuses we do not yet reach.* F. L. K.

VARIOUS VOICES

Brief Abstracts

Beliefs of Educators

There will shortly be available the results of a unique study entitled: The Philosophical Beliefs of Leaders in American Education by Dr. Frank C. Wegener, School of Education, University of Southern California. Three thousand individuals received extended questionnaires, and approximately a thousand answered. The scale for responses allowed five latitudes: Meaning not clear, definite approval, qualified approval, undecided, definite disapproval; and opportunity was afforded for detailed variations from the scale.

The object of the study was to arrive not only at the professions of belief of educators, but also their actual working attitudes. To this end several questions were written so as to include more than one conceptual term, others with conflicting terminological implications. In this way dilemmas were posed, and responses have been weighted accordingly. This was especially significant when answers showed no consciousness of a semantic or conceptual conflict. The scheme was set up around six attitudes: Pragmatism, Idealism, Scientific Realism, Scholasticism, Aristotelianism, Eclecticism; and persons addressed were invited to indicate which of these approximated the philosophical position, if consciously realised. It is significant that no special provision was made to detect those conscious of an entirely new state of affairs emerging in philosophy today (transcendental realism), but the study incidentally affords some clues about this, Dr. Wegener informs us.

A group of questions will interest our readers and give them an idea of the scope of the study. The following are numbered 21 to 30, in the total series of 50 questions: Man is essentially a material and biological organism without supernatural or spiritual attributes. Mind is more than a product of materialistic factors; mind has a spiritual nature. Speculative philosophy which transcends the problems of practical living is pointless. Primary reality consists of ideas or ideals which transcend human sense experience; these ideas are the true objects of thought. Man possesses an intelligence which transcends a merely material concept of mind; this intelligence is derived from Infinite Mind. For man there are no eternal truths; truth for man depends upon what can be demonstrated in particular situations. God created man; he created him for the purpose of man's happiness; this happiness is realized perfectly only in God. Man can adjust himself adequately to his environment without consciously taking all reality into account. Experience is the sole source of human knowledge, it is extremely doubtful that man can have any knowledge beyond that which is demonstrable to his senses.

Concepts in Industry

Arthur D. Little, Inc., of Boston, have circulated the report of a singular address by Mr. Roland P. Soule, of the American Machine and Foundry Company, New York, before the New England Research Council, and published in *Chemical and Metallurgical Engineering* for July, 1946. The subject is *A Brief Research into Research*, and the following analysis of industrial research and expansion over the last eighty years raises a point of importance to Main Currents policy:

> "1860-1880 was the era of the civil engineer. It was the period of the nation's greatest geographical growth, when the west was being opened up and the country was being physically built. It was the period of construction of both canals and railroads, the former already in their declining years and the latter just rising toward the peak of their importance.
>
> 1880-1900 was the era of the electrical engineer. Of Bell and the telephone. Of Edison and the electric light. And of the rise of electro-metallurgy. Hall and aluminum, Willson and calcium carbide, Acheson and graphite.
>
> 1900-1920 was the era of the mechanical engineer. Of Olds, Selden, Ford, Winton, and the automobile. Of the Wright brothers and the airplane. Of the development of prime movers of all sorts and the greatest application of power to in-

dustry. It was the period of refinement of machine tools and labor-saving machinery. Of the development of the principle of interchangeability in manufacturing and the resulting rise of mass production of articles of all sorts.

1920-1940 was the era of the chemical engineer and the metallurgist. Of the manufacture in this country of many chemicals previously imported before the first World War. Of the rise of the process industries: petroleum refining, glass, paper, rubber, and non-ferrous metallurgy."

Mr. Sproule then asks this question: "But what about the next twenty years?" He inclines to believe that no old conventional type nor some new type such as "electronic engineering" will display ascendancy in the next period. "Instead, it seems much more likely to be characterized by the further breaking down of such barriers and boundaries as still exist between present types of technologies."

On a just-completed tour of the United States the present writer noticed more than one tendency to realize that our conceptual breakdown will reflect itself in industry as well as in higher education. And there is already, in Chicago, a Concept Development Corporation. These groups are certain to increase in number, and colleges and universities must be prepared to serve them with properly equipped graduates. Among them, as Mr. Soule makes clear, there will be recognized a new relationship of consumer to producer. The vertical big-profit kind of thinking must be supplanted by a broader based, and socially conscious kind of responsibility. Here again the role of higher learning becomes intensely practical and urgent.

F. L. K.

Waves and Angles

Concerning the wave nature of matter, everyday experience shows that there are natural vibrations and cycles of all kinds, associated with all forms of matter and energy. Recurrent behavior is evident in the heavens, cloud formations, weather and sunspot activity; in civilization, business, and individual moods; in living plants, animals, and micro-organisms; in high speed machinery, music, light, and electricity. Our living bodies give immediate evidence for the great variety of cyclic phenomena peculiarly associated with life: there is the rhythm of breathing, the faster pulse of the heartbeat, the still faster alpha, beta and delta brain wave rhythms.

John J. Grebe, Director of the Physical Research Laboratory of the Dow Chemical Company has made the statement that "the major portions of all our technical and scientific activities have to do with cycling of all kinds . . . All the natural sciences deal with cycles of various frequencies which, if undesirable, should be understood and controlled at their inception, rather than fought with violent action after they are in full swing." Dr. Grebe illustrated the amazing number of correlations in a *frequency* chart (1) binding energies from molecular to nuclear, (2) electron beam energies, (3) the electromagnetic spectrum from magnetic disturbances to cosmic rays, (4) wave lengths of de Broglie particle waves, (5) mechanical and thermal vibrations, from those of constellations to those of atoms, (6) vital cycles, from civilizations to cell devisions, and (7) radioactive half-lives, from Uranium II to Thorium C'. So seriously does Dr. Grebe regard the industrial implications of cycles that he considers comprehensive unifications of the kind, "the logical starting point for our education in the sciences."

The most recent mathematical and philosophical theories stress the *field* rather than the particle as the fundamental entity. Recent biological evidence strongly suggests the existence of a biological guiding field which in principle strongly resembles the electron's behavior pattern; it arises in the living organism, expands beyond the body boundaries, governs the growing processes and transcends the material contents. (*The Periodic System and Atomic Structure.* III-Wave Mechanical Interpretations, William J. Wiswesser. Cooper Union, New York City. *Jour. Chem. Education.* 22, 418-26 (1945). Abstract by A. J. Phillips.)

The Triple-Brained Dinosaur

In a talk by Reginald E. Gillmor, reported in *Mechanical Engineering,* January, 1946, he refers to a description in Dr. Edwin Colbert's book on the Dinosaur and to a verse by Bert Leston Taylor. "Consider the dinosaur . . . [and] what might be called its administrative organization. This organization comprised three autonomous centers—one in the head, which served primarily as a receptor for sight, sound, and smell; a second in the spinal column above the shoulders for controlling the forward part of the body; and a third near the rear end of the spinal column for controlling the hind legs and tail. An amusing description of this organization has been written in verse:

Behold the mighty dinosaur,
  Famous in prehistoric lore,
Not only for his power and strength
  But for his intellectual length.
You will observe by these remains
  The creature had two sets of brains—
One in his head (the usual place),
  The other at his spinal base.
Thus he could reason "A priori"
  As well as "A posteriori."
No problem bothered him a bit
  He made both head and tail of it.
So wise was he, so wise and solemn,
  Each thought filled just a spinal column.
If one brain found the pressure strong
  It passed a few ideas along.
If something slipped his forward mind
  'Twas rescued by the one behind.
And if in error he was caught
  He had a saving afterthought.
As he thought twice before he spoke
  He had no judgment to revoke.
Thus he could think without congestion
  Upon both sides of every question.
Oh, gaze upon this model beast,
  Defunct ten million years at least."

THE BIOLOGICAL BASIS OF IMAGINATION*

R. W. Gerard

A satisfactory interpretation of imaginative phenomena in terms of neural mechanisms may be presented by some fortunate author at a future time. But even now there is still much of substance to be said . . . In dealing with imagination it will be profitable . . . to examine its common meaning, to consider how psychological study has defined and measured relevant mental abilities, to note the relation of local brain damage to these abilities, and to develop the relation of these psychological phenomena to neural mechanisms.

WHAT IS IMAGINATION?

Imagination is more than bringing images into consciousness; that is imagery or at most hallucination. Imagination, creative imagination, is an action of the mind that produces a new idea or insight . . . The thing comes unheralded, as a flash, full-formed . . . Imagination supplies the premises and asks the questions from which reason grinds out the conclusions as a calculating machine supplies answers . . .

It deserves mention that imagination re-enters at all stages of intellectual endeavor, it does not merely deliver a mental foundling to the care of other faculties of mind . . .

Imagination is one manifestation or index of how the brain machine works, which in turn depends on how it is built. And since sensory data are shaped by such reworking, imagination pervades all thought and knowledge. This is far from saying, as some do, that imagination offers a separate avenue to truth or reality, one alternative to sensation and depending on some act of spiritual apprehension or revelation or of ancestral or racial insight . . . What is denied our senses (or their instrumental extension) and what escapes through the meshes of "the a priori net of the mind," in Eddington's phrase, is lost to us. On the other hand, since the properties of nerve fibers and nerve cells clearly determine the character of sensation and, only less clearly with present knowledge, determine the character of imagination and reason, and since these last are called into action directly or indirectly by sensory nerve impulses set up by receptors which probe the surroundings, it is not surprising that sensing and thinking do jibe with each other and have some degree of valid correspondence with a real universe . . .

Since [the imagination] product enters consciousness abruptly, its workings are at the unconscious or uncritical level . . . Pursuit of imagination leads us into the unconscious and its mechanisms . . .

Form, structure, relationship, organism (or org in my usage), part-whole systems, gestalt, or closure is basic for the product of imagination and for its process . . . Since imagination only regroups sensory material, there is truly nothing new under the sun.

THE PSYCHOLOGY OF IMAGINATION

Beyond sensation and even simple perception, involving the correlation of current sense data and of past experience, closure is a basic property of mind . . . Thus Conrad notes the ability to combine parts or elements into a whole, to integrate systems; and also the converse ability to identify parts or elements in the whole, to fragment or differentiate systems. And Wertheimer further recognizes the ability to shift from one whole to another one, to restructure a system.

These activities may seem tautological restatements and are certainly closely related intuitively; yet, as we shall see, they enjoy considerable independence and can be separately measured. Most immediately exemplifying imagination would seem to be the last, flexibility of structure; for Wertheimer correctly says, "Creative thinking is the process of destroying one gestalt in favor of a better one." . . . And, as an indirect sign that even such intangible mind work may still be sharply tied to the properties of the brain, there is the observation (Brickner) that stimulation of just one particular small region of the exposed human brain is able to arrest movement in thought. A conscious patient counts smoothly except while the electric current is acting, when the same number is simply repeated. Thus (with the period of stimulation italicized) the subject says, "1, 2, 3, 4, *4, 4, 4, 4, 4,* 5, 6, 7, . . ." . . .

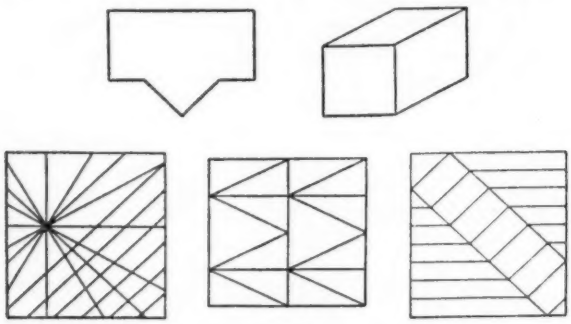
If imagination is a definable property of the mind it should also be measurable; and as the definition progresses from the vague impressions of ordinary human dealings to that offered by standardized situations, so the measure moves from the subjective judgment of a person, as having a good or poor imagination, to a fairly quantitative statement about performance. Thurstone, especially, has pressed forward the analysis of mental abilities. By extensive testing with a rich variety of problems he has shown at least seven such abilities which are independent of each other. Thus, individual A may outperform individual B by ten—or a hundredfold on tests which utilize ability 1, while B may similarly outperform A on tests involving ability 2. A similar analysis has revealed some ten perceptual abilities, and others surely remain to be uncovered. . . .

Is imagination some one or several of these separable abilities or some common "power factor" underlying them? The answer is not yet available, but it is within easy grasp when persons of outstanding talents of various sorts are measured by such standardized tests. Meanwhile, some interesting guesses may be made. At least four of Thurstone's factors might be involved in imagination, and one of these seems almost to define it. The I, or induction, factor is the ability to see logical patterns or relations (and so would be less related to imagination than to reason). A convenient test for it

*Abstracted (by R. B. Whorf) from **The Scientific Monthly**, June, 1946, with special permission of author and publisher. This condensed argument denies us the rich verbal illustrations and some allusions of the original, but follows the argument faithfully, and forms a valuable summary by a distinguished authority of present knowledge and opinion concerning the topic.

is to have the subject supply the next item of a series. A very elementary series is: OXXOXXOX? A more severe demand is made by: 1, 7, 3, 6, 5, 5, 7, 4, 9? The K factor measured by the Rohrschach "ink-blot" test, is almost at the other end of the mental spectrum and, far from impinging on logic, plumbs the unconscious....

Two other factors rather specifically deal with closure. The A factor is the ability to make a closure or complete a gestalt and is measured, for example, by having the subject identify partially erased pictures or words. The E factor is the ability to replace one closure by another and is tested by the Gottschalt figures (see fig.), or by "hidden faces" in a picture of different



GOTTSCHALT FIGURES

The Instructions read as follows: One of the two upper figures is contained in each of the three lower drawings. Only one figure in each drawing should be outlined.

manifest content. The two abilities, especially E, are rather precisely those considered earlier in defining the act of creative imagination. . . . When such primary abilities have been measured in our Einsteins, Edisons, Toscaninis, Van Goghs, Masefields, and Lincolns we shall be far along the way. . . .

I may mention evidence that a strong hereditary element is present for "averaged" intelligence and for particular talents. . . . A study of outstanding contemporary virtuosi and singers by Scheinfeld shows that two-thirds of the parents of these artists possessed high musical talent. . . . The importance of the hereditary factor is further attested by the age at which these outstanding musicians had clearly manifested unmistakable talent — an age under six years! . . . That the growth of mental *capacity* is more a matter of biological maturation than of life experience is suggested by all these findings, as well as by the high performance of children on some of Thurstone's factor tests. . . .

THE BRAIN AND IMAGINATION

It remains sadly true that most of our present understanding of mind would remain as valid and useful if, for all we knew, the cranium were stuffed with cotton wadding. In time, the detailed correlation of psychic phenomena and neural processes will surely come; but today we are hardly beyond the stage of unequivocal evidence that the correlation does exist. . . . Yet the gap is narrowing, and a primitive bridge is offered by the grosser disturbances of brain and mind. Perhaps most dramatic are the aphasias, a group of disturbances in the ability to handle "meaning," associated with more or less sharply delimited regions of brain damage. . . . Aphasia may . . . prevent sensation from emerging into meaning, meaning from eventuating in behavior, or meaning itself from coming clear. The last would be a disturbance in closure or structuring. This represents, perhaps, the basic disintegration of imagination. Imagination may be the word for that all-important no man's land between the end of the receptive process and the start of the expressive one.

The future is parturient with the answers. For the advance of neurosurgery is offering to study clean-cut cases of brain defects (or stimulation); patients with local brain amputations or incisions for tumors or infections or even, rather less soundly, for mental disturbances. . . . Thus, at the receptive levels, superficial damage to a region (17) of the visual cortex destroys color sensations but preserves pattern; more profound damage destroys pattern recognition as well while leaving (as in the monkey) light sensitivity. . . . And at the integrative or imaginative levels of meaningfulness, we need only the results of applying the tests for primary abilities, especially for Thurstone's A, E, I, and K factors, to patients with specific brain operations to make a great step forward. . . .

ANATOMY

Clearly, a knowledge of structure and localization of function is not enough; for a single nerve impulse running in a single nerve fiber in one or another part of the brain is much the same thing, and a billion of them simply added together are only a billion of the same things. But nerve impulses are not simply added. . . . A person listening to a watch tick hears it as louder while a light is being looked at; . . . The point is that as sensory messages ascend toward and into the cerebrum they are not merely relayed and regrouped, they are also reorganized and reworked; in fact, we shall see they even reverberate.

What may be the conscious concomitants of these various stages of neural work is not known; but all the evidence suggests that they would rise in richness along with the intricacy of activity patterns in the nervous system. If awareness is the internal view of events or systems which are material to the external view, as many hold, then some proto-consciousness (probably not self-consciousness, or an awareness of being conscious) must exist in the simplest blob of living protoplasm or, for that matter, even in all substance. But, just as behavioral capacity leaps upward when a nervous system is present and again as each major improvement in it evolves, especially as the great cerebral cortex comes to flower, so subjective awareness does likewise. . . .

Between perception and imagery on the one hand and volition on the other lie the great mental territories of imagination and reason. It might be useful to consider imagination as the culmination of sensory events, reason as the origin of the motor ones. Or perhaps reason, with its attendant logic, verbalization, decision, and willing, is more properly the start of motor events, and imagination is the more pervasive and encompassing mind work which is the keystone of the sensory-motor arch. Men with moderately severe brain injuries may perform well on the usual intelligence tests, while fall-

ing down on those which sample imagination. Indeed, imagination may include a "power" factor of intelligence underlying the others, as Spearman believed, and depending on the mass functioning of the whole brain, as Lashley's work on animals suggests.

Certainly, as earlier outlined, imagination depends on sensory information. Man cannot see the world other than as it unfolds itself within the sensory projection areas of his brain. These determine his basic orientation to externality. In the very special arrangement of the areas of vision, skin, and muscle sense is embedded an unformulated geometry. The basic units of physical science are distilled from these areas: space (centimeters) from vision, touch, muscle sense, and the vestibular system (the balance organs located within the ear); substance (mass, grams) from smell, taste, touch, muscle sense, and secondarily, vision — a congenitally blind person, on achieving vision, feels objects "hitting" his eyes until he learns to project his experience into the third dimension, as we all project the sense of touch to the end of a stick with which we explore the bottom of a pond — and perhaps, even, the notion of force comes from touch and muscle sense, of matter more from taste and smell; and time (seconds) most directly from hearing. At least, as evidence for this last, is the powerful reaction to heard rhythm, tapping to a tune, and the fact that a sound track of words or music run backwards is completely meaningless, whereas a reversed light track, though often ludicrous or impossible, is perfectly meaningful. Moreover, one's subjective judgment of time certainly depends on a brain clock, which runs fast in fever according to a precise mathematical function of the brain temperature (Hoagland) . . . From space, mass, and time comes, in turn, the notion of entity — the basic gestalt of all and the first flutter of imagination. In this sense, that entity is given by the sensory organization of the nervous system, Kronecker's famous mathematical dictum takes on a profounder meaning: "God made the integers, man did all the rest." . . .

PHYSIOLOGY

What, then, of the mechanism of brain functioning, of the generation of thought? Granting, again, that the exact relation between neural processes and conscious events remains unknown, it is still possible to recognize some striking parallels. Are closure and patterning basic to imagination? They are simply shot through the entire feltwork of the nervous system! Not only in the large-scale organization we have already noted but in the small-scale one no less. . . . It is the collective and patterned actions of the several billion nerve cells of our brains that determine our behavior and accompany our thoughts. . . .

A few years back, the only well-recognized pattern was the reflex arc. A message entered along a sensory nerve, continued through the nervous system along direct or relayed connections, and finally emerged in a motor nerve. Except as messages were in transit, the nervous system was presumably quiet. Today we know, largely from the electrical pulses of the "brain waves," that nerve cells are continuously active in wake or sleep, and many beat on like the heart. . . .

[By many and varied] integrating mechanisms . . . in the brain . . . great masses of nerve cells — the brain as a great unity — act together; and not merely do two or a billion units sum their separate contributions, but each is part of a dynamic fluctuating activity pattern of the whole. This is the orchestra which plays thoughts of truth and beauty, which creates creative imagination. . . .

Plenty of problems remain; some demand attention. Most urgent to our present theme is how novel neural patterns originate, since they must accompany novel thoughts or learning in general. . . . So long as our picture of the nervous system was that of the telephone exchange, with reflex plugs all set and each sense organ subscriber connected with, and able to call to action, its alloted muscles, the appearance of new responses seemed to demand the presence in the brain of rather mysterious telephone operators to shift the plugs. Now, with our discovery of a far more fluid nervous system, one unceasingly active and with neural and electrical messages rippling the whole into dynamic patterns, which flow from one contour to another as present influences play upon the condition left by past ones — with such a picture the arrival of new neural relationships is no great problem. Schemata have been offered —in terms of nerve impulse balance, electrical fields, fiber growth—which at least indicate reasonable avenues for further exploration. . . .

A final problem . . . of our analysis: What is the neural basis for the striking quantitative differences between man and man in intelligence or in the several abilities which constitute intelligence or its component, imagination? Surely brain size as such is not the answer, as many studies have demonstrated. Perhaps absolute or relative size of the association areas would show better correlation with intelligence; or perhaps the richness of fiber connections and the architectural intricacy — as the more elaborate circuits make the better radios, large or small. And the factor of activity level is almost surely involved; not only the size and number of nerve cells but their rates of beat, maintained potentials, irritabilities; their functional vigor. This, in turn, depends on their compositions (make what you will of the fact that the brains of women contain a higher percentage of lipins — fats — than those of men) and on their metabolism; and this, on the blood supply and the amount of oxygen and sugar it brings, on the salt and acid and other components of the tissue fluids, on particular stimulants and depressants, as the thyroid hormone or anesthetic drugs, and the like . . . As the sets of facts are brought together new understanding will arise. Possibly from this direction we shall get a clue as to the finer differential between brains: what gives one man a vivid imagination but a poor memory, another an encyclopedic memory but dull imagination. And when that answer is at hand science will indeed have established the biological basis of **imagination.**

Herewith (Nos. 44 to 100) is concluded the publication of principles of biology assembled by W. Edgar Martin, of which the first forty-three items appeared in MAIN CURRENTS for July, 1946, with kind permission from *Science Education*, Vol. 29, Nos. 1 to 3, 1945. In the meantime we have received from Dr. Walter S. Lundahl, Biological Science Department of Michigan State College, a closely systematized statement of basic principles which have been formulated under the guidance of Dr. Chester A. Lawson, head of the department, for use particularly in the Basic College. This list is to be considered a skeletal framework upon which a course in biological thinking can be constructed. We print it in its entirety, as an organized summary of the hundred items in Mr. Martin's list, and as an aid in organizing thought about life in terms of principles, which are here defined as "Facts, theories, and laws which provide explanations or indicate interrelationships on a broad scale." A list of secondary principles is being formulated at Michigan State, and notice of these will occur in our pages in due course.

44. Water is essential to all living things because protoplasmic activity is dependent upon an adequate water supply.
45. The germ plasm of animals and plants passes on from generation to generation and there has been a continuous stream from the first organisms to the present living organisms.
46. Parent material for the development of soils is formed through the physical disintegration and chemical decomposition of rock particles and organic matter.
47. From the lower to the higher forms of life, there is an increasing complexity of structure, and this is accompanied by a progressive increase in division of labor.
48. The work of the chlorophyll of all chlorophyll-bearing plants is essential to all living things.
49. Osmosis, the diffusion of molecules of a solvent (usually water) through a semipermeable membrane (a layer of cells or the membrane of a single cell) from the point of higher concentration of the solvent to a point of lower concentration, with a stoppage of the flow of molecules of the solute, is a basic process in plant and animal physiology.
50. The continuance of higher forms of life in anything like the present kinds and numbers would be impossible without bacteria and molds. They break down the complex carbohydrate and protein substances of dead plants, and animals into simpler substances which may then be used again by living plants.
51. All life comes from preceding life.
52. The organisms most likely to survive and reproduce are those that are structurally and physiologically best fitted to their environments.
53. Certain one-celled organisms escape adverse conditions by forming highly resistant spores which often survive until conditions are again favorable.
54. Every individual organism is composed of distinct hereditary characters which are transmitted by distinct hereditary factors (genes). In a hybrid the different parental genes are combined. When the sex cells of the hybrid are formed the two parental genes separate again, remaining quite unchanged and pure, each sex cell containing only one of the two genes of one pair.
55. There is a cycle, from inorganic substances in the air and soil to plant tissue, thence to animal tissue, from either of the last two stages via excretion or death and decay back to the air and soil. The energy for this everlasting rotation of life is furnished by the radiant energy of the sun.
56. All living things, except chemo-synthetic bacteria, depend directly or indirectly on photosynthesis for food.
57. An animal cannot live without proteins. They are necessary in cell growth and maintenance; so are necessities in the diets of animals. Plants are able to use carbohydrates and nitrates to build up the proteins necessary for growth and maintenance of their cells.
58. Energy can be transformed into mass and mass into energy, but the sum total, mass plus energy, remains constant.
59. New kinds of living things have arisen through mutation.
60. All gradations of association occur in intimate associations between organisms, from those which are mutually beneficial to the individuals concerned (symbiosis) to those in which one member secures all the advantage at the expense of the other.
61. Digestion accomplishes two things; it makes food soluble in water, thus enabling the nutrients to pass through membranes and thereby reach and enter the cells; it reduces complex nutrients (fats, proteins, and carbohydrates) to simple building materials which in turn can be rebuilt into whatever living material or structural feature is necessary at the place of use.
62. Except for those organisms which exhibit metagenesis, all living things are able in one way or another to produce new living things like, or nearly like, themselves.
63. All plant and animal life, along with the climate and varying weather, plays an active part in helping to form and to change the soil.
64. Carbon dioxide set free during the respiration of both plants and animals is absorbed by plants and used as a raw material of photosynthesis.
65. There are no elements in living matter which are not found in its lifeless environment; the energy

by which life is operated is the same energy by which the simplest physical and chemical transformations are brought about.

66. In general, living things give evidence of a definite progression from simple to complex forms.
67. Since the genes of the two parents combine at random in the germ cells and since the germ cells meet at random in fertilization, the individuals of any generation occur in certain predictable ratios.
68. The range of temperature for life activities is very narrow as compared with the range of possible temperatures. There is a minimum temperature below which, and a maximum temperature above which, no life processes are carried on. The temperature range for life processes is from many degrees below 0° C. to nearly the boiling point of water.
69. The secretions of the endocrine glands are absorbed directly into the blood stream from the gland tissue that produces them and are absorbed from the blood by the tissues of the organs whose activities are regulated by these substances.
70. In many multicellular organisms body form is secured and maintained either by the consistency of the tissues and the internal pressure of body fluids, or by the secretion of special substances which are formed into supporting structures.
71. Diffusion, the spread of fluids with their dissolved substances, throughout the protoplasm of a cell or the tissues of an organism is an important method of conveying oxygen from the surface of a cell to the interior, or digested foods from the place of digestion to the protoplasm that will use them, or substances that stimulate any activity to the organ that responds to them, or the waste materials from the place where they are stored or excreted.
72. The fundamental process of reproduction in all organisms whose cells possess nuclei is cell division which results in the precise distribution of the chromatin of the nucleus.
73. The hereditary characters in all organisms are determined by the genes which are carried in the chromosomes.
74. Decomposition of the carbon compounds of organisms provides a replenishment of carbon in the atmosphere in the form of carbon dioxide. Thus carbon is continually subjected to a series of cyclic changes from living to non-living substances.
75. All individuals of the first generation of hybrids, the F_1 generation are uniform in appearance in alternative inheritance; only one of the two parental characters, the stronger or the dominant one, is shown. In intermediate inheritance a mixture of the parental characteristics is shown.
76. All living things, except a few anaerobes and autotrophic bacteria, secure their energy by oxidizing food.
77. Each kind of living thing has its characteristic chromosome complement, and the constancy of that complement is preserved at each cell division. Different species show the utmost diversity in number, size and form of chromosomes.
78. In all organisms, increasing complexity of structure is accompanied by an increasing division of labor.
79. The power of contraction which results in movement is possessed by all protoplasm to a greater or lesser degree.
80. All cells produce certain chemical compounds, secretions, which may be used in the processes going on within the cell, in cavities adjoining the cells, or at considerable distances from the cells where they are produced.
81. Every living species is continually producing a multitude of individuals many more than can survive, varying more or less among themselves, and all competing against each other for the available energy.
82. When the balance of nature is disturbed, disastrous results often follow.
83. Reproduction in all organisms is a process of growth in which a single cell or a group of cells is separated from the parent body and develops into a new individual.
84. All cells arise through the division of previous cells (or protoplasm), back to the primitive ancestral cell (or protoplasm).
85. Each species of living organism is adapted, or is in the process of becoming adapted, to live where it is found.
86. Plants and animals are directly or indirectly dependent on the soil.
87. Anaerobic decomposition (fermentation) is accomplished at ordinary temperatures by the intervention of special enzymes; dissimilation occurs in the absence of oxygen; its final products are carbon dioxide and alcohol; and free energy is released.
88. The smallest unit of living material capable of existing independently and of maintaining itself is the unit called the cell.
89. All the modes of reproduction of organic life are alike in their nature, varying only in complexity of development. They fall into two general categories, asexual and sexual reproduction.
90. All embryos start from a single fertilized egg cell and grow through division and redivision into the form of the organism which produces the egg cell.
91. Sexual reproduction is an almost universal method of reproduction and occurs in representatives of every phylum of plants and animals.
92. Oxygen free in the atmosphere or dissolved in water supplies the respiratory needs of practically all living organisms, except for a few parasitic and anaerobic animals, and a number of bacteria and fungi which can extract the oxygen needed for their energy production from the organic substances on which they feed.
93. The phenomena of life involve chemical change, so that wherever life processes are being carried on, chemical changes are taking place. However, chemical change may proceed without involving life.
94. Every animal comes into the world with a certain inherited endowment of congential behavior.
95. Growth and repair are fundamental activities of all protoplasm.
96. In a living organism adaptation of action and adaptation of structure are necessary for revival.
97. In the second and later generations of a hybrid, every possible combination of the parent character occurs, and each combination appears in a definite proportion of the individuals.
98. For each disease caused by an organism a specific microbe exists.

99. Heredity supplies the native capacities of an organism; environment determines to a large extent how fully these capacities will be developed.
100. Chlorophyll-bearing plants are adapted for food making.

A Summary of Biological Principles

(from the Basic College, Michigan State)

I. Cells are the units of structure and functions of all organisms. A. The elementary parts of all tissues are formed of cells.

II. All life processes are due to the activities of protoplasm, which is the living substance of cells. A. All protoplasm has the power of movement. B. All protoplasm is irritable; that is, it may respond to stimuli. C. Life is accompanied by metabolic processes; that is, living protoplasm absorbs matter from without, changes it chemically and physically and incorporates this matter into the living system and concurrently breaks down substances with the formation of waste products. D. Life is dependent on an exterior source of energy. 1. The ultimate source of energy utilized in metabolism is the radiation from the sun. 2. Only green plants, those containing chlorophyll, are able to utilize solar energy in the manufacture of organic foods. 3. Living things obtain energy from organic foods. E. Living protoplasm respires; that is, protoplasm breaks down organic foods with the liberation of energy. 1. The energy liberated by respiration is utilized in the organism for production of heat, for synthesis of chemical compounds, for movement and for other metabolic activities. F. Metabolic processes are carried on in the presence of enzymes, organic catalysts, which are manufactured by the organism and are present in every cell. 1. Digestive enzymes hasten the breakdown of insoluble organic foods to a soluble state. G. Water is the principle solvent in which all the metabolic reactions take place and the solvent involved in absorption processes, hence it is essential to the activities of protoplasm. H. Growth is due to an increase in the amount of protoplasm. 1. In multicellular organisms growth is usually accompanied by an increase in the number of cells, followed by the increase in the size of the newly formed cells. a. In the formation of new cells, except reproductive cells, the nucleus divides in such a manner that each new cell contains the same quantity and quality of chromatin material (chromosomes) as the mother cell. b. In the formation of the sex cells (maturation) the nucleus divides in such a manner that each new cell contains half the quantity of chromatin material (chromosomes) of the mother cell, except for sex chromosomes. 2. Growth of an individual or a population tends to be slow at first, then to be very rapid, and finally to slow down until a stable level is reached. I. Protoplasm arises only from pre-existing protoplasm. 1. All cells arise from pre-existing cells. 2. A fundamental process of reproduction in all organisms is cell division. 3. Growth and metabolic activity are necessary prerequisites to reproduction. J. All cells of a species, except the sex cells, contain the same kind and number of chromosomes. K. Hereditary characteristics are determined by genes which are located in the chromosomes, and these genes are passed from one generation to the next as part of the nuclear material passed from parent to offspring. 1. Genes are distributed during maturation and fertilization in definite ratios. L. "Like begets like"; that is, offspring belong to the same species as their parents. M. The embryos of sexually reproduced organisms start from a single cell, the result of fusion of two gametes.

III. Living things have evolved; that is, new species have arisen from pre-existing species. A. Living organisms tend to reproduce in greater numbers than can survive. B. Offspring are never exactly like parents. C. There is competition between individuals for space, food, and others necessities of life. D. Cooperation is a determining factor for survival. E. Natural selection, the sum total of the effects of the environment, acts ultimately to determine which individuals and, hence, which species will survive. F. The closer the resemblance between two organisms the more recent is the common ancestor. 1. The degree of similarity between organisms is dependent on the degree of relationship between them. G. In the evolutionary development of complex forms there has been a progressive increase in complexity of structure and this is accompanied by a progressive increase in the division of labor.

IV. No species is sufficient unto itself; living organisms are dependent for their continued life on other living organisms. A. The substances which make up living organisms pass through a continuous cycle from inorganic to organic (part or product of a living organism), from organic to inorganic and so on indefinitely. 1. There is no element in living things that is not found in the lifeless environment. 2. There is a cycle of elements from the soil and air to the green plant, then to animals or non-green plants, and by way of any of these back to the soil and air. 3. Energy and matter are neither created nor destroyed in the reactions associated with life processes. B. Adaptations may arise by evolutionary changes, by changes in the kinds of species in a community, by changes in the populations in a community, and by changes in each individual. C. A fluctuating balance in populations and species is maintained through the interrelations of organisms. D. The physical conditions for life are limited. E. In all groups of organisms there are parasitic relationships.

RECENT ITEMS

Vital and Geometrical Electrodynamics

The following summary of an article was prepared by the author, Alexis L. Romanoff (Cornell University Agriculture Experiment Station) for *Biological Abstracts,* August-September, 1945 (13051). The original

appeared in *Biodynamica* 4:329-358, 1944, with ten illustrations. "The developing egg, like all living organisms, plants and animals, maintains a certain 'surface potential'. When the organism is suspended in an isotonic liquid medium the electrodynamic field is perceptible even at some distance from the organism. All the more physiologically active points on the egg or on the embryo are negative to all less active points, and the whole organism is negative to the surrounding medium. The magnitude of the electrical potential increases with embryonic development; in the chick embryo of eighty to a hundred hours it is about ten millivolts. The potentials have been experimentally increased by electric stimuli, x-ray and ultraviolet radiation, high frequency field, and high oxygen concentration. The source of energy for the development of electric potential is the metabolic activity of the organism. At death the electric properties disappear."

The Love-Songs of Mosquitoes

Love-songs of mate-seeking mosquitoes have been recorded on phonograph records in the public health laboratories of Cornell University Medical School, by Dr. Morton C. Kahn, Dr. William Celestin, and Dr. William Offenhauser. Their intention is to use these mating calls to lure the death-carrying pests to their own death in traps. The insects' sounds, often only faintly audible to the human ear or even quite inaudible, were greatly amplified before being recorded. Some species, such as Aedes egypti, carrier of yellow fever, have hitherto been thought to be entirely mute, but the experiments demonstrated that they have songs of their own, only outside the range of human hearing.

A number of interesting things about mosquitoes' singing were learned in the course of the work. With practice, the experimenters learned to distinguish between the songs of various genera of mosquitoes, as one can tell the difference between the songs of birds. Not only that, they found differences between the songs of male and female mosquitoes. Voices of male mosquitoes were found generally to be higher pitched than those of females, but the female insects had louder voices than their mates. Even at their loudest, however, they were often so faint as to be imperceptible to human ears, even when a hundred or more of the insects were induced to sing in chorus. Such chorus of males can be provoked by getting one female to start singing.

Mosquito sounds are as a rule not especially high-pitched. They have a frequency range between 200 and 1,500 cycles per second, which is about the middle of the frequency range for human hearing. Solitary mosquitoes never sing; two or more must be together. If two mosquitoes of the same sex do not choose to sing, the addition of a third of the opposite sex, will often start the chorus going. But the calls are not all alike. They seem to have a variety of emotional contents. One type of song will be a mating call, another will indicate anger, a third a warning of danger.

Additional recordings are now being made, and as soon as conditions permit each significant tone will be tested in the laboratory and in the field, to discover its possible usefulness for trapping mosquitoes. The present report is in *Science*, March 30, 1945 as abstracted in *Science News Letter*, April 14, 1945, page 231.

Significance in Art and Science

A subtle but important mutual relevance is developing between the physicist's professional mind and that other portion of his mind which appreciates music or poetry or other arts . . . It is a commonplace of all writers in the philosophy of science to underline the contemporary contrast between a conceptual world of electrons, electron waves, electromagnetic fields and the world of sense perceptions, touch, impenetrability, visual perception, etc. . . . It is also a commonplace . . . that when a modern artist draws, carves or paints anything, he sometimes deliberately makes it fail to look like any actual situation as reported by visual or photographic experience . . . In science we aimed for centuries at the replacement of mere geometrical description of Nature by causal sequences or mechanical models . . . The great triumphs of this strategy led in the earliest years of this century to a regard for mechanical causal modelling, as the essence of physical explanation of phenomena, but thereafter we had to face a succession of healthy disillusionments. There came first the Relativity proof that electromagnetic wave propagation cannot be mechanized to the extent of visualizing a medium. Next came the fact that quantum restrictions had to be superposed upon electron orbits without any causal sanction. Then a pair of incompatibles, wave mechanics and particle mechanics, were found to be both simultaneously true for different aspects of the behavior of matter and also of radiation. The later Einstein generalization, ascribing gravitation to the 'curvature of space', still further blurred the notions of substance and cause . . . Finally there came the Heisenberg demonstration that spatio-temporal quantities are not definable below quantum limits, and Dirac's insistence that the essential variables of physics are not those mechanically picturable in terms representing any copy of macroscopic experience . . . There is a liberating as well as a disillusioning aspect of this modern development: we gain much from being content to manipulate a wave equation for predicting verifiable frequencies and intensities, without waiting to know what oscillates or in what medium.

During the same era . . . the French impressionist painters . . . also learned to forego as aim the mere copying of the dimensions and colors of perceived objects. The great Victorian Frenchmen rediscovered and developed what had been found in post-Renaissance centuries, that a primary concern of the visual artist is Luminosity in ordered pattern and its effect upon the mind, and that outline and color are means to this effect, rather than ends . . . the proof of Significance is that the pattern shall arouse in the observer's mind some response depending upon his own memory and imagination. If this obligation is fulfilled . . . the work of art has no need to resemble in linear or angular dimensions

anything which might be recorded in perception or upon a photographic plate.

The common feature survives these important psychological distinctions between the artist's and the physicist's mental processes: in art 'significant form' sums up that communicability which confers any title of truthfulness, and in physics it is again 'structure of formal relationships' rather than 'things' which we are learning in modern times 'to know'. The scientific mind may succeed in extracting Significant Form from a work of art which a less disciplined critic would miss. Similarly a mind trained in the aesthetic judgment may grasp the essential bearing of some scientific theory of the widest communicability and may foresee its extension which was missed by the scientific mind overloaded by technique or text book. It has been in this sense that some of the greatest masters of recent physics, Lorentz, Einstein, Rutherford, Bohr, Dirac, are essentially artists and their contribution to physics has required that side of their genius. Only because Heisenberg's matrices and Dirac's groups predict measurable facts do we prefer them to Bohr's more picturable orbits, which omitted some of the facts. (*The Physicist's Mind and the Judgment of Art,* Martin Johnson, D.Sc., in the Journal of Scientific Instruments 22, 121-5 (1941). Abstract by A. J. Phillips.)

Aloneness in Children

Dr. Leo Kanner, Child Psychiatrist of Baltimore, has reported an unusual mental illness affecting children born into certain intelligent families, nearly half of whom are represented in *Who's Who* or *American Men of Science.* These children seem to live in a world of their own, in which other humans have no place. The hands that take care of them are seemingly objects unassociated with another living being. When a toy is taken away or stepped on, the child becomes angry at the offending hand or toy, but never looks up at its owner. Seven of the twenty children so far observed have never learned to talk, but even those who have do not use speech to convey meaning to others. They usually do not pay any attention when spoken to, and they show no interest whatever in conversations going on around them. The children are, however, not feebleminded; on the contrary they all have good intelligence. Some have even been considered infant prodigies. One little boy, in a family possessing considerable musical talent, was able at the age of a year and a half to discriminate between eighteen symphonies. He would recognize the composer and say his name as soon as the first movement started. Another child when three years old knew the words of thirty-seven songs and also many nursery rhymes.

Apparently from the beginning of life these babies have lived alone "in a shell," and have shut out, ignored or disregarded anything coming to them from outside. The mother of almost every child reported that never had her baby held up his arms to be picked up. Left alone, the children seem happy, and they handle inanimate objects with skill and pleasure. They have an anxiously obsessive desire for sameness and stability. Changes of routine, of surroundings, even of furniture arrangement may be violently upsetting to them.

Dr. Kanner raises the question as to whether the intellectual gifts of the parents might not have contributed materially to the illness of these children. For the most part their parents, grandparents, uncles and aunts are persons strongly pre-occupied with abstractions of a scientific, literary or artistic nature, and are limited in genuine interest in people. Yet the children's "aloneness" from birth makes it difficult to attribute the illness entirely to relations with the parents.

(*Science News Letter,* August 11, 1945, p. 92)

Sighing

Sighing and other forms of overbreathing in emotionally unstable persons produce many symptoms which apparently are unrelated and involve various organs and organ systems. On closer examination these are found to be part of the symptom complex which has been named the hyperventilation syndrome. This syndrome is a distinct clinical entity, a manifestation of the fear reaction. Confronted by a situation in which he is inadequate, the person who has had similar experiences of inadequacy will overbreathe, usually sighing or gasping for breath. This starts a sequence of physiological and biochemical changes involving the entire organism and resulting in physical symptoms. The patient's attention is focussed upon a particular organ or organ system, since his symptoms frequently simulate organic disease. His anxiety is transferred to the suspected disease, his psychic conflict being ignored.

Selected case histories have shown that this syndrome simulates organic disease in the absence of pathological changes. In rare cases it may be coincident with organic disease. In view of these findings, the physician should consider the hyperventilation syndrome in his differential diagnosis and so avoid labelling a neurotic patient with an organic disease. The existence of this syndrome may be verified by a simple hyperventilation experiment. (*Sighing and Other Forms of Hyperventilation Simulating Organic Disease,* by Dr. Gliebe and Dr. Overback, *Journal of Nervous and Mental Disease, May,* 1944).

Race Theories

On February 8th, a well-attended meeting of the Manchester University Branch of the Association of Scientific Workers heard a lecture on "Race Theories" by Prof. F. Wood Jones. The differences between various types of men are sufficient for them to be classified in three distinct species, the leiotrichi or mongol, the ulotrichi or negro, and the cymotrichi. The last-named species to which we belong is rather less easy to define. Since interbreeding between the species readily occurs, the view that there is only one species *Homo Sapiens* has been widely held. Numerous zoological and botani-

cal examples of the interbreeding of species with the production of fertile offspring are now known, and it is therefore again justifiable to speak of three distinct species, particularly as they can be distinguished in embryo less than three months old, as well as in fossil remains of the pleistocene period. Within these species are numerous sub-species or races, each with distinct characteristics. Segregation, whether geographical or religious and political as in the case of the Jews in Europe, tends to produce such races. Nevertheless in Europe at the present time there is no nation in which more than 10% of the population belongs to a pure race. The belief that half-breeds of certain races inherit the worst qualities of both races is quite unfounded. The belief probably arose because in certain cases only the least desirable elements in both races produce such half-breeds. Professor Wood Jones strongly advocated intermarriage between all races.

(*Nature*, February 20, 1943)

Patterns of Culture

Dr. Benedict's *Patterns of Culture* give us a psychological study of three differing types of society: the Zuni of New Mexico, restrained, gentle, ritualistic; the Krakiutl of Vancouver Island, emotional, religious, property-conscious; and the Dobu of the Southern Pacific. One impression that arises from a reading of these studies is the effect of a social ideal on the intimate lives of every citizen in that society, and also the restraining effects of the unquestioned acceptance of social tradition. No matter how fine that social tradition may have been in its origin, when it becomes an automatic control over generations of living persons it becomes evil. It enforces a static condition on life which by nature is dynamic. Authoritarianism, whether social, political, or religious, is authoritarianism, with all its crippling effects on human nature. It is especially in the study of the Dobu that we see the oppressive power of social tradtion making its full impact. Here is a society perpetuating the most horrid of human characteristics, deceit, cruelty, hostility, suspicion, and black magic. Because this tradition is so obviously destructive of higher values, it highlights the whole problem. We can become beglamoured by the perpetuation of social traditions that seem pleasant or romantic, without realizing that the dehumanizing effects in killing creativity are just as serious.

The stark realism of the effects of unrevised social tradition in *Patterns of Culture* leads one to wonder how far our modern and progressive societies are being crippled by idolatry of established tradition. No tradition is sacred. The sacredness lies not in what men in times past have created, but in the fact that man possesses the function whereby he can constantly recreate tradition. The point here is that under each of the social patterns studied by Dr. Benedict lies a structure of consciousness that requires understanding. It is a structure which can be used to function destructively as with the Dobu, or be deliberately oriented to constructive ends. Thomas Davidson taught that our culture was the vehicle of the transmission of acquired characteristics—in other words, that it is the vehicle of the evolution of the purely human element. What is human about us is not so much our physical structure, which we share with the higher animals, but our creativity, our ability to reflect, evaluate, and act deliberately. These abilities are properties of human consciousness, though to be sure they arise out of man's biological nature. Since man created language for communication, it has served not merely for the horizontal exchange of thoughts among contemporaries, but also for the perpendicular communication of ideas through generations and centuries of time. That transmission should recreate tradition. Whatever changes are to take place in society must first take place in the consciousness of men. The Dobu people could become socially the equivalent of the Zuni, if their social consciousness were reoriented to ideas similar to those of the Zuni.

O. L. R.

BOOKS IN REVIEW

SIGNS, LANGUAGE, & BEHAVIOR — Charles Morris

In the words of the author, "This book aims to lay the foundation for a comprehensive and fruitful science of signs. It attempts to develop a language in which to talk about signs, whether the signs be those of animals or men; whether or not they themselves constitute a language; whether they are signs in science or signs in art, technology, religion, or philosophy; whether they are healthy or pathic, adequate or inadequate for the purpose for which they are used . . .

"The present study is based on the conviction that a science of signs can be most profitably developed on a biological basis and specifically within the framework of the science of behavior . . .

"The issue is not between 'mentalism' and 'behaviorism,' but is solely a methodological problem; are such terms as 'idea' 'thought,' 'mind' more or less precise, interpersonal, and unambiguous than such terms as 'organism,' 'stimulus,' 'response-sequence' and 'disposition to response'? In choosing the latter terms we but express the belief that they are the more suitable for scientific advance."

He first proceeds to isolate behavior and to outline a set of conditions for something to be a sign: *"If anything, A, is a preparatory-stimulus which in the absence of stimulus-objects initiating response-sequences of a certain behavior-family causes a disposition in some*

organism to respond under certain conditions by response-sequences of this behavior-family, then A is a sign." On this beginning the following method of building a language to talk about signs is proposed: "Any organism for which something is a sign will be called an *interpreter*. The disposition in an interpreter to respond, because of the sign, by response-sequences to some behavior-family will be called an *interpretant*. Anything which would permit the completion of the response-sequences to which the interpreter is disposed because of a sign will be called a *denotatum* of the sign. A sign will be said to *denote* a denotatum. Those conditions which are such that whatever fulfills them is a denotatum will be called a *significatum* of the sign. A sign will be said to *signify* a significatum; the phrase "to have signification" may be taken as synonymous with "to signify."

". . . Where an organism provides itself with a sign which is a substitute in the control of its behavior for another sign, signifying what the sign for which it is a substitute signifies, then this sign is a *symbol*, and the sign-process is a *symbol-process;* where this is not the case the sign is a *signal*, and the sign-process is a *signal-process* . . ."

After treating individual behavior, the problems of language and social behavior are taken up and such terms as *communicator, communicatee, reciprocal, non-reciprocal, consigns, lansigns,* and *lansign-systems* are introduced in the vocabulary of the language in which to talk about signs.

When the use of signs by an organism under various environmental conditions is considered, several modes of signifying become apparent. These the author defines as *indentificative, designative, appraisive, prescriptive,* and *formative*. The corresponding usages he calls the *informative,* the *valuative,* the *incitive,* and the *systemic* use of signs. He then discusses adequacy, truth, and reliability in relation to each of the four usages.

By taking the modes of signifying and the four usages as coordinates, sixteen major types of discourse are classified. Each is then analyzed in detail to show how this classification is a useful basis for the evaluation and control of discourse.

EXAMPLES OF THE MAJOR TYPES OF DISCOURSE

Mode/Use→ ↓	Informative	Valuative	Incitive	Systemic
Designative	Scientific	Fictive	Legal	Cosmological
Appraisive	Mythical	Poetical	Moral	Critical
Prescriptive	Techno-logical	Political	Religious	Propagandistic
Formative	Logico-math-ematical	Rhetorical	Grammatical	Metaphysical

Extracts from the analysis of scientific discourse are typical of the method employed: ". . . any statement which cannot be confirmed or disconfirmed has no place in scientific discourse. For science seeks knowledge, and knowledge as the term is here used, requires evidence. If therefore it is impossible to obtain evidence (direct or indirect) that a statement is true or false, the statement in question falls outside of science . . . Those statements for which at a given time the evidence is low are called *hypothesis,* while the best confirmed statements are called *laws* and form the basis for the systematization of science.

"Science moves toward its goal by first restricting itself to the designative element in signifying. Then it attempts to gain greater precision by the development of co-ordinate systems which permit greater refinement in temporal and spacial identification, by the substitution of numerical signs for the indefinite 'some,' 'few,' 'many' and 'most' of everyday discourse, and by the introduction of carefully defined designation which signify characteristics of the environment neglected or unnoticed at simpler levels of observation. Finally, it develops an elaborate machinery of instruments, experiments, and training in order to improve the technique for selecting those statements which denote (and so are true) from those which do not denote. Such pruned, organized, constitute the body of scientific knowledge at any time. Any discourse composed of such statements is scientific discourse."

It is on this scientific basis which the author outlines that he seeks to lay the foundation for a scientific *semiotic*.

The final chapters of the book are devoted to the "Individual and Social Import of Signs" relative to art, personal post-language symbols, pathology, social control and communication; and to "The Scope and Import of Semiotic." Pragmatics, semantics and syntactics are included in the scope of semiotic under the following definitions: "*pragmatics* is that portion of semiotic which deals with the origin, uses, and affects of signs within the behavior in which they occur; *semantics* deals with the signification of signs in all modes of signifying; *syntactics* deals with combinations of signs without regard for their specific significations or their relation to the behavior in which they occur."

The import of semiotic extends to a program for linguistics, a unification of science, the place of psychology within science, scientific humanistics, the language of philosophy, and semiotic for the individual, society and the school.

Dr. Morris has developed a system which is consistent throughout and which still is adequate for diverse application. If his terms find their way into general academic parlance with his usages, semiotic should provide a sound basis for communication between the various departments of knowledge and for resolving many differences in opposing systems of thought.

Included as an integral part of the work is a glossary of the terms developed, a bibliography of semiotic sources, and an appendix which traces the history of semiotic and gives an analysis of contemporary work.

THEODORE ANDERSON

Signs, Language, and Behavior, by Charles Morris, Prentice-Hall, New York, 1946, $5.

THE PERSON IN THE BODY — L. E. Hinsie

"It is becoming increasingly evident that the mind has as rich an ancestry as the body has. The mind does not start *de novo* at birth, except from the standpoint of contact with the environment. The mind in its most pristine manifestations is already present and in operation at birth, constituting what is commonly known as the sphere of the instincts. The infant is a reproduction of phylogeny, that is, a reproduction of primitive man.

"Habits, reflex in nature, are observable in intrauterine life. 'From the standpoint of development psychology, the whole life cycle is a continuum, and the growth of the mind begins with the growth of individual behaviour.' Rudimentary body reflexes appear two months after conception; mouth movements are observable in the third month. By the seventh month of intrauterine life 'most of the vital reflexes necessary for extrauterine existence are well advanced . . . There is good reason to believe that the infant of six to nine months, whether within or without the womb, is already a habit-forming creature, able to learn through processes of conditioning.' . . .

"The structure of the personality is first played upon by intrinsic factors made up of organic cravings and impulses, such as hunger, thirst, defecation, sleep, love, hate, imitative activity, curiosity, and so on. Some of these internal stimuli are clearly organic in nature, others have the essence of personality, so to say, though each is closely allied with a vegetative type of existence. The science of infancy is not sufficiently advanced to allow any sharp distinction to be made between the mind and the body during the early months, perhaps for a year or more. It is a well-known fact, however, that bodily energy expresses itself in ways that we are accustomed to speak of as emotions. The infant laughs, cries, shows resentment, registers dissatisfaction, indeed he runs the gamut of emotional activities before the outside world has exerted its pressure upon him.

"For purposes of description words have been coined to designate the 'source' of these emotionally toned activities. The word most commonly used by psychiatrists today to refer to the original sphere of instinctual activity is *id,* meaning the 'it', the reservoir of psychic energy, containing all phylogenetic mental acquisitions and their instinctual components. The id is a hypothetical zone, deeply embedded in tissue but in later development extending beyond tissue, at least in its functional manifestations. Comparatively little is known of the exact relationships between the id and the soma (tissue); its anatomy, physiology, and pathology are known more by inference than by exactitude, yet without such an assumption the practical applications of psychosomatic medicine would lose much of their value.

"The current keynote is the inseparability during early infancy of the psyche and the soma. The one looks like the other; the one has many characteristics of the other. It is at this stage of development that the foundation for psycosomatic medicine is laid; upon this successive floors are erected, floors that make up the building that we call personality . . .

"The situation today in the field of mental medicine may be viewed from two different angles, each of which, however, converges upon the same object, man. From the one vantage point, active research is going on with the idea of determining what influences the mind can bring to bear upon the body. Can grief so alter the organic physiology of the body that disease may be the consequence? Can a stomach ulcer come about as a result of persistent tensions due to frustrations in life? Or must other factors be present in the stomach wall, such as constitutional deficiencies or alterations in the acidity or bacteria, before emotional tensions can play a part in the production of an ulcer? . . . It would appear, however, that many biological disorders may be a consequence of the combined action of mental and physical elements and that it is no longer tenable in the description of an ailment to refer to the causes as either mental or physical . . .

"Freud separated the instincts from the body for the purposes of study, though he never lost sight of the fact that they exist naturally within it. Psychoanalysis is, and always has been, a psychophysical field of investigation and treatment. We must accept, however, as a working hypothesis, the idea that instincts and their manifestations cannot yet be studied by materialistic instruments of precision. New standards of measurements have had to be constructed and used, taking human behavior as the material for measurements . . .

"The object of mental treatment is to remove symptoms and to create or restore harmony between the body and the mind, on the one hand, and between the person and his environment on the other. The basic principle behind psychotherapy comprises a loosening of the emotions from their unnatural and abnormal sites of attachment, such as the heart or stomach, and their relocation upon healthy, constructive environmental interests. It is characteristic of the emotions that once they become habituated to certain ways of expressing themselves it is difficult for them to advance to new and more progressive methods of adaptation. We are in the habit of saying that this or that person is in a rut. What we really mean is that his emotions are fixed to given patterns of reaction, that they are not free to shift from their old attachments to new ones. A psychosomatic disorder is a kind of compromise in that the emotions move from the mind to the body, thus gaining outlet, but in the disguise of ill-health. Through alleged bodily disease, not only are the pent-up emotions released but they gain a certain measure of respectability when they mimic a physical disease.

"Treatment of a psychosomatic disorder consists of four major steps: first, a careful separation of the emotions from the bodily organ under investigation; second, a restoration of those emotions to the original trend of mental interests (mother, father, brother, wife, etc.) from which they sprang; third, full recognition by the patient of the abnormal attachment not only to the body organ but also to the mother or father or self, as the case may be; fourth, the placement of the released emotions in channels of sound environmental issues . . .

"It is an old-fashioned and ineffectual idea to recommend a vacation in the interest of a psychosomatic illness. Vacations do not vacate a physical complaint of mental origin. Too frequently they accomplish exactly the opposite result, because they provide added opportunity to concentrate upon an illness.

"The advice, 'forget about it,' is even more useless. No one knows better than the patient how utterly helpless he is in efforts to forget something over which he has no control. How can anyone be expected to forget what he does not know, namely, the cause of his troubles? He may momentarily forget the results, that is, the symptoms, but as long as the causes continue to operate, he will be plagued with symptoms."

From *The Person in the Body*, an Introduction to Psychosomatic Medicine, by Leland E. Hinsie, M.D., W. W. Norton, 1945 (pp. 32-34, 35, 41, 43, 63, 74, 252-254).

IF MEN WANT PEACE

Faculty Members, University of Washington

If men want peace they will do well to read this remarkable volume, far too little noticed, although it is the joint work of about thirty members of the faculty of the University of Washington, well integrated, beautifully published (Macmillan), frank, readable, and quite devoid of academic aloofness and of nationalistic snobbery. Our readers will be convinced on the two latter points upon learning that the authors of the second chapter (The Problem of Security) quote more frequently from the *New Yorker* than from any other source journal. This is the antidote for the pompous parade of solemn works which have added to the despair of parental readers who expect leadership from the campus but find to their surprise they have to take a good deal of it from Superman, Walter Winchell, and Frank Sinatra.

The standard set by the editors accounts for the achievement, in part. It is clear that they and the contributors determined that all the generally discussed topics should be brought up to date by means of simple historical treatment, neither dull chronology nor stuffed with overmuch detail. We get, in the first chapter, the reasons why world order under the League style collapsed, and the reasons are rested on quite simple elements from Europe's earlier political history. Next, all the efforts in conferences monetary, regional, and the like, before UNO are discussed, not wearisomely in themselves, but in the context of the forces which evoked them. Thus there is no bibliography required (something of a relief!)—but also no index is furnished (a very serious omission, in such a case). Next, the editors transfer attention from the legalistic and financial and other external machinery to that which some of us think is a theme too much neglected on campuses: Some Psychological Postulates for the Peace. This is the very heart of the discussion (Chapter XVII), and then follow Education, Arts and Letters, Science and Technology, Religion, Nationalism, The Need for a World Order, and The Moral Basis of Peace.

In general the writing is stirring because the thinking is so direct and the expression candid. For example, the authors of the chapter (XV) on Relief and Rehabilitation (Arthur W. Martin and Richard G. Tyler) say: "In the light of these considerations, it is clear that if Eastern and Southeastern Europe are to enjoy the substance of victory, they must have an economic revolution and not only a military triumph over the Axis powers. This revolution must comprise a consolidation of the farm strip system; development of cooperative processing and marketing . . ." and so on into the need for small machinery such as water pumps, fruit presses and the like. A surprising amount of detail gets in without being unreadable. This is expertness at its best.

By contrast, the chapter (XVIII) on Education is lamentably weak, possibly because of editorial policy, though there is plain speaking here too: "In short, education must play a large part in overcoming economic injustices" (page 223); "Above all let us not fall into the fallacy of regarding our own culture as the standard for others" (page 224). No solution is offered for our cultural disunity and conceptual breakdown, although the considerable degree of unity of the Middle Ages is recognized. In several places the current educational deprivations, disintegrations, inadequate improvisations are obliquely touched, but too lightly. We may suppose that this significant hiatus reveals the failure of light which follows upon loss of burning feeling. The higher learning in America is certainly still above the snow line, where nothing much grows, least of all new species.

The chapter on Arts and Letters speaks up. We shall close our discussion of this admirable book with a passage from it:

"It is not surprising, then, that Dorothy Thompson among others calls for a return to eloquence and declares that 'actually art has never been so divorced from the life of the masses of the people as in the last generation. Poets have written poems for other poets, painters have painted pictures for other painters—and the dealers—and the art of the people has been swing adaptations of great musical themes.' (*Saturday Review of Literature*, Dec. 2, 1944, p. 9.) Miss Thompson adds that even the so-called radicals in art have not really been radical. They have feared the mighty, and she offers a scripture from Walt Whitman in reproof. But she does not include from the mighty Walt my favorite among his manifestos for the artist:

'This is what you shall do: Love the earth and the sun and the animals, despise riches, give alms to everyone that asks, stand up for the stupid and crazy, devote your income and labor to others, hate tyrants, argue not concerning God, have patience and indulgence toward the people, take off your hat to nothing known or unknown, or to any man or number of men—go freely with powerful uneducated persons, and with the young, and with mothers of families—re-examine all you have been told in school or church or in any book, and dismiss whatever insults your own soul; and your very flesh shall be a great poem . . .'"

IF MEN WANT PEACE: The Mandates of a World Order, by Members of the Faculty University of Washington, Edited by Harrison, Mander, and Engle, Macmillan, 1946. $2.50.